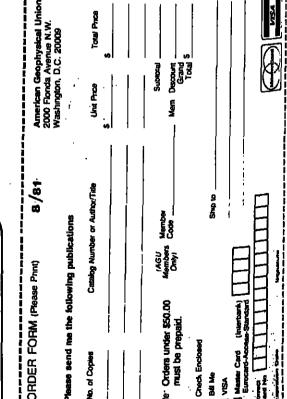


To Speed S Book Ord

EOS. TRANSACTIONS. AMERICAN GEOPHYSICAL UNION

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AUGUST 18, 1981



# Editorial

# Dues and Contributions

You will see a new line on the dues notice that you will posive shortly. It calls attention to AGU's fundraising efthis. The needs of AGU, like those of any other organizaoner individual, have risen both with inflation and with the matrity of our activities. Dues have not risen since 1968. issed, AGU has chosen to rely on pricing its services, ach as journals and meetings, on a cost recovery basis: his only those who participate in an activity are charged It is in this way, dues, which could be an economic barrier athe entry level, can be kept as low as possible.

in recent years, inflationary increases have reduced the Union's ability to build an adequate reserve. As a result we plass certain about AGU's ability to continue to serve our decidines in the face of economic and technological chalmys. In particular, I am concerned about the effects of maning technology on scholarly communication. Pioneerginareas involving expensive technology should be left to the most part to our big brothers, such as the American Chemical Society, the American Institute of Physics, and te institute of Electrical and Electronics Engineers. But we musl work with them in supporting roles and have the resuices to take up desirable options as they are proved vi-

able; otherwise, we will be burled. The loss to science and scientists would be irreparable, for without the revenue from our communication activities there is no AGU.

The AGU-GIFT fundraising effort was launched in order to build a reasonable reserve for the Union. Articulation of the need for the reserve and objectives of the drive were the first steps taken by the Council Committee on Financial Resources and the AGU-GIFT Steering Committee. The primary objective of the current drive is to raise \$1,000,000 through the membership over the 5-year period ending in 1985. When this effort is well underway an additional goal will be set for institutional support of the Union. You might ask 'How can the membership of the Union give \$1,000,0007

The AGU has over 13,000 dues-paying members. To speak in terms of averages for a moment, \$1,000,000 apread over 13,000 members during 5 years requires only \$15 from each member each year. Of course, averages in a case like this are almost meaningless except as a rough quide and as an ald in visualizing the problem. Surely, this calculation makes our goal seem somewhat less stagger-

In an effort to give all members an easy way to contribute, an entry has been made on each dues notice specifying a voluntary contribution of \$10. This is a strictly voluntary contribution, and the amount is only a suggestion. The important thing is that each member share in the effort. A high level of participation is essential to providing continuing momentum for future efforts, especially the attempt to gain institutional support. It is my hope that for every member who feels that the contribution is too high for his or her particular circumstances there will be another who will be moved to give more. More than half of the AGU-GIFT goal could be met in this way over the next 5 years.

These contributions are, in some ways, similar to a voluntary increase in dues, but they differ from dues in a very material way. Every contribution made in this way or through supporting membership will be credited as a contri-bution to AGU-GIFT. Dues are used for current operating needs, while AGU-GIFT is building a reserve that will prepare AGU to meet future challenges. You may specify, if you like, that your contribution be dedicated to the endowment fund or to another special purpose. With your participation, the Union will gird itself for whatever tomorrow brings. Join every other AGU member and show your support with a contribution that reflects the value of AGU to

**Geobarometers Clarify Crustal Doubling** 

Two University of Chicago geochemists report what they

believe is confirming evidence for the crustal-doubling the-

ory. The theory, which could explain the great height of the

Himalayas, says that parts of several continents were once

Robert C. Newton, professor of geology, and Dexter Per-

kins III, a postdoctoral research associate, report in an arti-

cle in the July 15 Nature that they have developed geoba-

rometers, or formulas, that relate the compositions of min-

erals in rock to the pressure at which the rock crystallized.

By determining the pressure, they can calculate the depth

at which the rocks were formed. Newton and Perkins base

their work on granulite rocks (found in Europe, Asia, North America, and Australia), which contain pyroxenes, plagio-

clase, gamet, and quartz. Thermodynamic measurements.

(News cont. on page 634)

buried to a depth of 35 km, the entire thickness of the

earth's crust.

Fred Splihaus

# News

#### **Dynamics Explorer Launched**

The Dynamics Explorer A and B (now 1 and 2) spacecat were launched into coplanar orbits from the Western 1st Range at Vandenberg Air Force Base in California on August 3, 1981, at 0956 UT. Although the orbits of the spacecraft are lower than expected, the change should not mode attaining the project's goals.

'All orbital parameters are nominal except the apogees. which, due to a short second burn of the second stage, are werthan planned, said Robert A. Hoffman, project scien-19, at the Goddard Space Flight Center.

OE-1 will move in a high orbit, carrying video cameras to Mograph the changing patterns of the northern lights. leanwhile, DE-2 will skim above the atmosphere from pole to pole. In its lower orbit, it will move much faster and will make many more observations of the polar regions. Also, it x\* pass through the upper atmosphere and ionosphere to measure the intense, external disturbances.

The orbit of the DE-1 is 575 km by 23,163 km (instead of 24,875 km) and that of the DE-2 is 609 km by 1012 km (instead of 1300 km). All major objectives of the mission should be achieved with the actual orbits, Hoffman told Eos. In addition, instrument activation is proceeding as scheduled with all Instruments on the DE-2 expected to be ready for operations before the end of August.

The spin axis of DE-1 is being magnetically torqued, Hoffman explained, to orbit normal, after which the long wire antennas and instrument booms will be erected and the spin rate adjusted to about 10 rpm. Completion of these activities is expected in mid September.

All spacecraft systems are operating normally, Hollman reported, except one of two battery charger control circuits on DE-2. Nevertheless, the DE team believes the battery will be functional. 'Operational workarounds are being developed to utilize this battery, he said.

The goal of the Dynamics Explorer program, according to NASA, is to enhance the understanding of the processes by which energy from the sun, in the form of light waves and matter, flows through interplanetary space, enters the region around the earth controlled by the magnetic forces from the magnetosphere, and eventually is deposited in the earth's upper atmosphere. This phenomenon produces the aurora, affects radio transmission, and might influence basic weather patterns. Information collected during the mission will lay the foundation for a four-satellite mission. dubbed Origin of Plasmas in the Earth's Neighborhood (OPEN), scheduled for the middle of the decade.

The results of space exploration over the last 2 years

ing available, and so it is not unusual to expect a round of

new speculation on their interior compositions and proper-

have provoked considerable and widespread interest, among geoscientists, in the interiors of the outer planets. Even new data on remote Uranus and Neptune are becom-

ties. In a very recent article in Nature (292, 435-436, 1981), one of the most eminent theoretical physicists in the

field of gas thermodynamics at high pressure has devel-

Livermore National Laboratory), taking into account the

knowledge that the outer planets have an inner layer, or

um in solar abundance), suggests that there could be a

the Nature article, entitled 'The Ice Layer in Uranus and

analysis of existing shock wave and theoretical data on

Neptune—Diamonds in the Sky?,' Ross makes a serious

methane, carbon, and hydrogen with which he compared the interior of Uranus (Neptune is very similar, he says).

The results could have far reaching implications in the the-

ory and understanding of the solar system. The postulation properties of the mantles of Uranus and Neptune could

cause magnetic fields and the generation of radio waves. What Ross suggests is that the 'ice' mantles of Uranus

and Neptune, being under intense pressure and tempera-

ture (roughly 2000-7000 K, 0.2-5.0 Mbar), have dissocial-

ed into carbon and hydrogen, which could form metallic diamond crystals. Under these conditions water and ammo-

nia become fully ionized, a condition that would mean the

Ross concedes that in a fluid of ionized water and ammo-

rila the diamonds would be gravitationally unstable and

would settle to form a dense layer.

absence of molecular compounds. In Uranus and Neptune,

Ross notes that magnetic fields could form in the maniles

of Uranus and Neptune and that the motion of charged par-

ticles trapped in the magnetic fields would generate radio signals. Radio signals may have been detected from Ura-

nus. The full consequences of Ross' findings are not yet

assessed. He points out that carbon in Uranus and Neptune constitutes 17% of the mass. A conducting (metallic)

carbon layer could have a significant effect.—PMB 3

mantle, consisting of forms of water, methane, and ammo-

nia (in addition to various proportions of hydrogen plus hell-

oped a model of the layered structures of Uranus and Neptune. Marvin Ross of the University of California (Lawrence

Diamonds in the Outer Planets

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Cover. Low and high confining stresses as explained by the diffinite for the confining stresses as explained by the confining stresses ted for low  $(\rho_1)$  and high  $(\rho_2)$  confining streams, critical crack lengths  $(\rho_1)$  and high  $(\rho_2)$  confining streams, critical crack lengths  $C_{\rm ex}$  and  $C_{\rm ex}$  for these conditions, and elastic loading followed by blied by a conditionally stable sliding path's and an intrinsically stable sliding path's and an intrinsically hy a conditionally stable sliding path'l and an intrinsically desired sliding path II. An except from AGU's latest addition to the Geophysical Monograph series (24), Mechanical Behavior of Cusial Rocks—The Handin Volume. For more information turn to 1988835.

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J. M. Logan, & D. W. Stearns

These three panels show the progressive changes of two continontal plates as they undergo crustal doubling. (See explanation in

taken over a period of years by Newton and Ole J. Kleppa, a physical chemist at Chicago, were used to derive the

Newton and Perkins found that the surface granulites from the worldwide sampling sites had been subjected to pressures of about 8 kbar, or about that which would be expected at the base of normal earth crust, about 35 km

The most plausible method for sending those rocks to such depths and retrieving them is through crustal doubling, Newton said.

Crustal doubling occurs when continents on the earth's plates collide, as shown in the first panel of the diagram. One continental plate subducts for a short distance under the other. A master fault, depicted as the dashed line in panel 2, or a series of less conspicuous faults can accommodate the uplift, Newton explained. But because the continents are buoyant, he continued, high elevations are created; great topographic heights, such as those of the Himalayas, are reached quickly with respect to geologic time. Granulite terrane that once covered the subducted plate is then buried under a full thickness of the earth's crust. These greatly elevated areas erode quickly, as seen in

panel 3, leaving the previously deep-buried rocks exposed. This exposed granulite terrane consistently shows evidence of having been buried and subjected to pressures of 8 kbar. They also are rich in continental shelf sediments, Newton told Eos. There is no question, he added, that these granulites long ago had been deposited on the sur-

Newton and Perkins also report that, 'Calculation of pressures for several terranes shows that the geobarometers yield reasonable and consistent results for the entire range of crustal pressures.' Other geobarometers, such as the one based on the reaction of cordierite to garnet, sillimanile, and quartz, are limited by the pressure ranges to which they can be used accurately.—BTR \$

# **National Technology Foundation Proposal**

A bill that would combine sections of the National Science Foundation and the Department of Commerce into a National Technology Foundation was introduced in June by Rep. George E. Brown, Jr. (D-Calif.), chairman of the House Science and Technology Committee. Purpose of the foundation would be to 'promote the advance of technology, technological innovation, technology utilization, and the supply of technological manpower for the improvement of United States. The bill has been sent to congressional

'Among other things, the National Technology Foundation would recognize the importance of engineering and help harness its potential, Brown told the House.

The loundation would comprise a National Technology Board, a director's office, and six functional offices: Small Business, Institutional and Manpower Development, Technology Policy and Analysis, Intergovernmental Technology. Engineering, and National Programs.

Under the bill, nine offices, services, and agencies would be transferred to the foundation. The National Bureau of Standards, the Patent and Trademark Office, the National Technical Information Service, the Office of Industrial Technology, and the Center for the Utilization of Federal Technology would move from the Department of Commerce. The National Science Foundation would turn over to the proposed foundation its Directorate for Engineering, Division of Industrial Science and Technological Innovation, intergovernmental Programs Section, and the Office of Small Business Research and Developmen

The bill (H.R. 3749) is a revised version of a similar bill introduced in the 96th Congress. The newer version takes' into account the reorganization of NSF to include an engineering directorate.—BTR 28:

#### NSF and NASA Budgets Increased

Research budgets of several of the federal government agencies were increased significantly over the Reagan administration's requests in the House of Representative's appropriations bill H.R. 4034. These budgets had been removed from the Reagan administration's omnibus reconciliation bill, and thus there were worries expressed that certain research funding could be in jeopardy. The rationale was that because the requests were voted on Individually on the floor of the House, many sections of the budgets would be subjected to extra scrutlny, which would lead to

more cuts. The National Science Foundation (NSF) budget request had been cut and reordered by the Office of Management and Budget (OMB) by making sharp reductions in programs of the social sciences and in programs of science and engineering education. There were lears that these programs would be reinstated to the original request level, at the expense of the budgets of other research activities. These lears materialized, but only momentarily. Efforts to cut the research activities by the House Appropriations Committee were soundly defeated. The budget was supported, with additional increases to provide for the education programs, by a high margin, which included most Republican and Democratic members of the House of Representatives. The overall NSF budget, as passed, has a total appropriation of \$1103.5 million, compared with the Administration's request of \$1033.5 million (the Fiscal Year 1981 appropriation for the NSF was \$1022.4 million). The House approved budget included increases of \$44.9 million in research and \$25.1 million in science and engineering education. Included in the research budget Increase were recommendations by the House Appropriations Committee for support of the social sciences and for the international affairs programs. Also included in the recommendations was support of interdisciplinary research programs that cut across the directorates of the NSF.

The House Appropriations bill provided increased support for the research budgets of the National Aeronautics and Space Administration (NASA). The Reagan administration has requested an overall research budget for NASA of \$6122.2 million, an increase of \$599.5 million over the Fiscal Year 1981 appropriation, mainly in the support of the space shuttle. The House raised the budget to \$6133.9 million, with the largest increase going to research and development (\$35 million increase over the OMB request), but there were budget reductions in research and program management (\$14.3 million reduction from the OMB request) and in construction of facilities (\$9 million reduction from the OMB request). The space shuttle program and related research will benefit, as will many others, such as the programs of technology utilization, energy technology, and space research and technology.

The budget of the Environmental Protection Agency (EPA) was also included in H.R. 4034. The EPA's budget was sharply reduced in the Reagan administration's request, and even though it was increased when the bill was ntroduced to the House floor, the total is still way down from last year's figure. The House approved a budget of \$1201.5 million, compared with \$1191.4 million in the Administration's request, and \$1351 million for the Fiscal Year 1981 appropriation.

Whether the increased research budgets will survive the final compromises after action by the Senate remains to be seen. There is a groundswell of support in Congress for research at this time.—PMB 🕱

# Forum

# Planning for Giving-

If your plan is for one year, plant rice; For ten years, plant trees; For a hundred years, educate people.

This ancient Chinese proverb stresses the importance of the role of AGU in the field of continuing education. When the Committee on Financial Resources made the recommendation that the Union should be on a firmer basis and the Council approved the 5-year fund drive, the vision was toward the future-decades at least-and far 1980 beyond 'rice' and 'trees.

A large percentage of AGU members contribute regulary and liberally to their aima maters. This financial supports universities and colleges is essential. The donors are well rewarded with the knowledge that their gifts are to be used for education

The same reward is available for the donor to the AGU Gift Fund to assure that the Union can continue to save to members by publishing the results of research and by hole ing stimulating meetings. Once the motivation to give is reached, the form of giving becomes important. The tax laws and regulations enable the donor to plan a series of gifts over an extended period. That was one of the reasons for the council support of the 5-year plan. The use of a pledge card indicates the 'intention' of the donor and an ables the steering committee to monitor the progress of the

We in geophysics have been fortunate and have prospered. The 'harvest has been good.' Whether it is the fall of the year' or the 'autumn of our lives,' let us make our plans for giving.

AGU

### **Bachelor's Degree Salary Report**

An update on salary offers to graduating college seriors Indicates sharp increases for those with bachelor's degress in engineering and science, according to the College Place ment Council

Students majoring in petroleum engineering draw the to offers: \$26,652 per annum, an 11.8% increase; some of an even topped \$30,000 per year! Second-ranked chemical engineering, at \$24,360, experienced a 12.7% gain. Since the July 1980 report, increases in average salary offers for the 11 bachelor's level engineering disciplines ranged im 10% to 14%,

On the other hand, students majoring in humanities a social sciences, who make up about 33% of the gradualist at the bachelor's level, accounted for only 4% of the job of fers reported in the survey, and their average beginning salary offers were only about half the top engineering ave age \$13,992 for other social sciences, \$14,448 for hu-



# One More Time

This was the view from Voyager 2 on July 12 as the spacecraft eped loward Salum (Slosest encounter with the plant 25, at 11:24 p.m. EDT. This picture, taken through ultraviolet, violet, and green this spows Saturn's rings brighter and incomplete than similar photographs taken by Voyager 1. The prightness is caused by a higher sun angle voyage courtesy of NASA is

manilles, and \$16,440 for economics. Percentage inpesses for these disciplines ranged from 8.8 to 12.1. The three business disciplines represented 22% of the hadhalor's offers and reported increases of over 9% to 11% in average salary offers since a year ago. The highest average offer in this group, \$17,016 went to accounting majors.
The seven scientific disciplines included in the survey accounted for 9% of the bachelor's volume. Computer science continued to dominate this category in number of oflers, but commanded second place in terms of dollar value. with a reported annual average of \$20,712, up 10.8%. The earth sciences and other physical sciences received the top dollar offer in this group. The annual average for this group was \$22,152, which was 19.6% higher than the July

At the master's level, chemical engineering recorded the lighest average at \$26,484 per year, up 13.4% since last year. MBA candidates with a technical undergraduate degree ranked second at \$26,268 per year, an 11.1% gain.-

#### Qeophysicists

Robert E. Cyphers, Jr., 65, a Life Member of AGU, dled on June 4, 1980. He joined AGU in 1941.

Eugene Leonardon, a Life Member, died on March 30, 1980. He joined AGU in 1933.

# **New Publications**

The Geology of Europe 0.V. Ager, John Wiley, New York, xix + 535 pp., 1980,

Reviewed by A. M. Celâl Şengör

For many years Derek Ager has been responsible for organizing and leading numerous delightful geological excursons in Europe; the reports of those undertaken under the agis of the Geologists' Association have been published in the proceedings of the association, whereas countless other excursions live only in the memories and field-books of those who have participated in them. The Geology of Euwe seems to be an outgrowth of its author's long-lasting we affair with his home continent (although he is an islanderi) and is one of the most entertaining regional geology books I have ever read. Much of it appears to have from out of the field-trip reports that Ager wrote for the recedings of the Geologists' Association. The book is Europe as seen by a stratigrapher-palaeontologist,' to quote its author. In one of the friendliest and most candid prefaces to any geological work, Ager makes it clear that what he narrates throughout the book is 'geology as it can be seen and as (he has) seen it (himself).' When I read though the book I was astonished to realize how much of the has really seen. On the spot comparisons of outcrops with similar ones in other far-away places on the continent leveal a vast reserve of knowledge of the particulars of the leology of Europe.

Following a useful map of the geological divisions of Eutope used in this book and an equally useful stratigraphic that showing all that the author believes to be 'standard' <sup>stati</sup>graphic divisions and their most commonly used alternatives from erathern to stage level, Ager discusses the general physiography, structure, and stabilization history of wope mainly after Stille's presentation in his immortal illindiragen der Vergleichenden Tektonik (1924), and explains how the now-familiar tectonic divisions Eo-, Palaeo-, leso-, and Neo-Europa were defined. He writes that 'these lefer to the age of the last major orogenic event affecting the rocks of the region concerned.' In Stillean terms (which sal make a lot of sense) his meaning would have been

European area had undergone major germanolype orogenles during the Mesozoic (in Teutoburgerwald Stille had in fact defined the first of his famous orogenic phases, that of the jungkimmerische!) yet it remains in Meso-Europa. Corresponding with Stille's four-fold classification, the

much clearer had he written last major alpinotype orogenic

event. As Stille himself often pointed out, the entire central

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searchers concerned with the following topics: Earthquake mechanics; geothermal energy

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rest of the book is divided into four major parts, each devoted to one of the major divisions. In Eo-Europa, the Precambrian shields and Phanerozoic platform regions are discussed under three headings: the Fenno-Scandian Shield, the Hebridean Province, and the East European Platform. Under Palaeo-Europa, Ager reviews the Caledonides and what he calls the 'Danish Triangle,' which includes the Baltic Plain, the North Sea Basin, and the Central British Block. Meso-Europa, part three of the book, includes the Hercynlan chains of Europe plus the Urals. In part four, Neo-Europa, Ager follows very much the traditional Kober-Stille classification of the Alpides into northern Alpides and southern Alpides plus the Intervening intra-Alpide massifs and basins, with a Staubian exception of the 'outer arcs.' Under this last category, the Pyrenees, the Ebro Basin, the Provence, the Jura and the Franco-Swiss Plain, Crimea, and the Greater Caucasus are assembled. The common denominator that characterizes all these objects is that they 'seem separate and distinct from the main continuous belt,' a statement only strictly true in a topographic sense. Ager's choice of presentation of Neo-Europa is unfortunate because it cuts through obvious palaeogeographic connections and confuses the reader. At the end of every part, he presents a synopsis and interpretation under the heading

'general conclusions.' Although good humor permeates the text (statements, such as 'Pyrenees are almost too good to be true,' are not rare in the book), and although a lot of interesting cultural background information is given along with geology (along cultural lines I caught Ager once! It was his mistranslation of Dikill Taş (p. 266) as 'stones thrown from heaven'; it actually just means obeliak with no reference from where it may have come), I have found the geological information itself unsatisfactory in terms of content and, not rarely, outof-date. Sketchy outcrop descriptions are indeed interesting, but they are often left 'hanging,' without having been woven into a coherent local and/or regional picture. Many of the geological sketch-maps and cross sections also suffer from old age (such as the cross section of the Massif Centrale after Lobeck). On the maps the lack of thrust symbols makes it impossible to see the relationships of units without having read the entire text, and even after that, in a few cases, questions remain in the uninitiated readers' mind. But the reader definitely gets the idea of the genuine complexities that baffle the field geologist. Also, for an introductory book of this sort, synthetic stratigraphical tables showing major lithologies, unconformities, deformation episodes, etc. and correlation charts relating them to one another would have been of immense value to the beginner. and would have been expected of an author who himself is a stratigrapher. Not a single stratigraphic column is to be found in the entire book.

In general, The Geology of Europe is a useful introduction to European geology for traveling nonspecialists. I would recommend it to all who would like to buy one book on the geology of Europe (certainly way above the recent four-volume French compilation entitled Geology of the European Countries, even if there were no difference in prices) with the reservation that they would get exactly what the author promises: the geology as it can be seen. The weakest parts of the book are the regional correlations and the tectonic interpretations. Ager's preferred interpretation of the plate distribution in the Mediterranean and their principal directions of relative movement (without time constraint, a naive concept in itself) is a good example of this

Owing to deliciencies of this and other kinds listed above. I find it difficult to recommend the book as a textbook for advanced courses in regional geology. Finally, the price of the hard-bound copy is a trifle too steep for the purposes for which the book was intended. A paperback version with a reduced price would have been much more suitable for many travelers and students.

A. M. Celâl Şengör, Department of Geological Sciences. State University of New York at Albany, Albany, New York.

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Geophysicist North Carolina State University—Raleigh. The Department of Marine, Earth and Almospheric Sciences is reopening the search to fill a presently available tenure track position in geophysics. Rank is at the Assistant or Associate professor level. A Ph.D. is required. Primary responsibilities will include generating and conducting research programs as well as and conducting research programs as well as teaching graduate courses in geophysics. The department currently consists of 31 regular feculty members including 16 in the areas of geology and geophysics. Please send resume and names of three references to J. L. Langfelder, Head, Department of Marine, Earth and Almospherio Sciences, North Carolina State University, Fieldigh, NC 27650. Deadline for receipt of applications is December 1, 1881.

Cember 1, 1981. North Carolina State University is an equal opfaffirmative action employer.

probe. The Electron Microscopy Center at Texas A&M University invites application for the position of electron microprobe specialist. Applicants should sass a working kno leade of Minz and c sectrometers and accompanying computer and interest programs and preferably have had expen-

ence in the geological sciences.

The primary duties of the position are to oversee and maintain (with the aid of service contracts) the electron microprobe and ancillary equipment and to assist in leaching graduate course laboratories dealing specifically with electron microprobe analysis. Salary will be a maximum of \$20,000-12 months. Applicant should send supporting data and letter

of recommendation to: Dr. E. L. Thu/ston Texas A&M University Biological Sciences Building College Station, Texas 77843 Texas A&M is an equal opportunity

Space Physics Research Position. Appl-cants with background in Interplanetary space, su-rors and magnetospheric research, and/or apace instrumentation are sought. Successful candidates will work with ISEE particle date and/or with auroral Will work with the control of the co mé to Professor George K. Parks, Space Sciences, Geophysics Program, University of Washington, Seattle, WA 96195.

The University is an equal opportunity employer.

University of Hawail/Faculty Positions. The Department of Geology and Geophysics and the Hawaii Institute of Geophysics have openings for the 1981-1982 academic year. Rank is open dewho will participate in our teaching and rese program in any of the following areas: (1) structural geology and marine tectonics; (2) hydrology and engineering geology; (3) marine seismology, mag-netics, and gravity. To apply send a letter of inter-est, a current vita and 3 letters of reference to Dr. S. O. Schlanger, Chairman, Department of Geology and Geophysics, University of Hawaii, 2525 Correa Road, Honokulu, Hawali 96822 (808-948-7826), or Or. C. E. Helsley, Director, Hawali Institute of Geophysice, same address (808-948-8760). Open until

The University of Hawaii is an affirmative action

Research Pealtiens/Seismology. Applications are invited for two possible research positions in the institute for Geophysics. University of Texas at

Austin, an equal opportunity employer.

Both positions involve field work on setsmograph metworks in Latin American countries, analysis and interpretation of data acquired from these networks and related selsmological studies in the Caribbean and South America.

one Ph.D. level and one B.S./M.S. level posi-tions are available. Salary for either position will be arranged depending on experience. Please send Resume and Bibliography to Tosimetu Matumoto, Institute for Geophysics, University of Texas at Austin, 700 The Strand, Galvaston, Texas 77550.

#### Assistant/Associate Professor Mackey School of Mines University of Nevada-Reno

The Department of Geological Sciences invites applications for the tenure track academic year position of assistant or associate professor of Geology to teach undergraduate and grad courses (M.S. and Ph.D.) We are seeking an out standing person with potential for teaching, establishing new laboratories and conducting and su pervising research in the Basin and Range and adjoining Provinces. Publishable research will be expected. Areas of expentee within geology which will receive favorable consideration are structural geology, sedimentology, stratigraphy and carbon

The position will be filled in either January or August 1982, depending on the availability of candidates. The Ph.D or equivalent degree is required. Salary and rank will depend on education and tence. Candidates should send a letter of application, list of publications, statement of teaching and research interests and transcripts and should arrange for at least three letters of refcrence to be sent to the Department. Closing clate for application is November 15, 1981. Applications are to be sent to: Dr. L. C. Hsu, Chali man, Faculty Search Committee, Department of Geological Sciences, Mackay School of Mines, University of Nevada, Reno, NV 89557 University of Nevada is EOE/AAE

University of California, Santa Barbara/As elatant Professor of Geography. Tenura track position available July 1, 1962 Ph.D. required prior to appointment. Strong commitment to research and teaching and good background in computer and mathematical quantitative skills required. Major area of specialization should be cartography with other research and toaching interests in human geography. Submit resume, bibliography, and names of three referees to: Dr. Reginald G. Goledge, Chairman, Department of Geography, Unirersity of California, Santa Barbara, CA 93106 Closing date: December 31, 1981.

Equal opportunity affirmative action employer Faculty Positions: University of Petroleum & Minerals, Dhahran, Saudi Arabia. The Department of Earth Sciences will have faculty pons open for the academic year 1982-83, start-Ing 1 September 1982 in the following areas a Hydrogeology b. Petraleum Geology

- d Photogeology Geomorphology

Minimum qualifications include Ph D degree plus

field industrial teaching experience Faculty will be involved in both teaching and research. Ability to teach geologic field courses is particularly desired. Good research facilities are available and specialized equipment for approver research projects may be acquired. Current research includes saline deposits, subkhaha region structure, geotechnical properties of local soil and rock types. It also includes micropaleons rofacies analysis, stratigraphical analysis of both auriace and aubsurface sections, computerized bibrographies and geologic data banks, theoretical and applied studies of seismic surface waves, rock

magnetism and paleomagnetism. Language of instruction is English. Winimum regular contract for two years, renewable Competitive salaries and allowances. Air con-ditioned and furnished housing provided Free air transportation to and from Dhahran each year. Attractive educational assistance grants for achoofage dependent children. All earned income without Saudi taxes. Ten months duty each year with two months vacation with salary. There is also possibility of selection for university's ongoing summer pro-gram with good additional compensation

Apply with complete resume on academic, prolessional and personal data, list of references, pubscattons and research details, and with copies of degrees and or transcripts, including home and of-fice addresses and telephone numbers to: University of Petroleum & Minerals

2223 West Loop South, Suite 410 Houston, Texas 77027

Position in Reflection Selsmology/Rice University, Houston, Texas, The Depart ment of Geology plans to expand its geophysic nsis will be on reflection seism . At this time applications are for the first of two en faculty positions. The successful applicant will help in the search for and selection of the second

Your main responsibility will be to lead out department into the area of modern reflection seismology. Your main toaching and research interests should be in the acquisition and processing of rellection seismic data. You should also help in devoloping rigotous undergraduate and graduate cur-ricula, which are supported by the traditional strength of the Math Sciences, Physics, and Electric al Engineering Departments at Rice. Enthusiasm to work with and undertake some joint projects with Dur geologials la essentia

Our plans are to acquire a computer system configured for high quality data processing. Substantia seed money for this facility is already in hand. Crealive cooperation with line oil and geophysical in-dustry in Houston, including a reasonable amount of consulting, is encouraged. Salary will be com-mensurate with qualifications and experience. lease send your curriculum vitae, a summary o experience in seismic processing, a statement of rosearch interests, and names of three or more references to Dr. A. W. Baily, Chairman, Department of Geology, Rice University, P.O. Box 1892, Hous-ton, Texes 77001. Application deadline—October 1,

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Atmospheric Scientist/Group Head. Senior staff scientist position available immediately at the NAICs Arecibo Observatory. The successful applicant will be appointed as Head of the Atmos icos Group and will be expected to lead that group and to perform inde ine Arecibo facilitios. A Ph.D. degree in atmos ic or physical sciences or radar engineering and a record of solid research accompli juired Experience with radar studies of the stratesphere, mesosphere, and lonosphere or with HF difications of the lonosphere is desirable. So open. Please send resume and names of at least three references to Dr. Harold D. Craft, Jr., Acting Director, NAIC Observatory, Space Sciences Buildng. Cornell University, Ithaca, New York 14853. fAIC-Cornell University are EOE/AAE

Petroleum Geophysicist/New Zealand Geological Survey. New Zealand is undergo-Ing major expansion of its energy resource investi-gations including prospecting for hydrocarbons. The Department of Scientilic and Industrial Research, the principle Government R & D Agency, and advito government and industry in science and technology, has a vecancy in its Geological Survey for a seismic interpreter. The position, in the Petroleum and Basin Studies Section requires a person

with a sound geological background primarily for regional analysis for the Basin Studies Programme Chalifications: A good 4 year bachelor's degree or higher, and at least 3 years petroleum explorace, are prefe Salary: A salary of up to NZ\$23,520 per annum

is offered for this position, depending on qualifications and experience.
Further information, application forms etc., may be obtained from the Ambassador Extraordinary and Prenipotentiary, New Zealand Embassy, Washon D.C. Applicants should quote Vacancy No. 2557 and forward applications, accompanied by a

The Ambassador Extraordinary and Plenipo New Zealand Embassy Observatory Circle, NW

ington OC 20008 Closing date for applications November 3, 1981.

City University of New York, (Brooklys lege): Faculty Positions. The Department of Geology anticipates filling several tenure track positions at Full Protessor level. (Salary range up to \$43,400). Highly qualified individuals will be linguished appointments at an dditional \$5,000.

While candidates who have distinguished them selves in any field are welcome to contact us, we are particularly interested in openings in: energy resources (coal/petroleum), exploration geophysics, onmental geology or hydrogeology, coasta

edimentology, economic geology. Successful applicants will be required to institute an active research program, supervise Master's with current vitae should be sent to: Dr. S. Bhatte charli, Chairman, Dept. of Geology, Brooklyn College of City University of New York, Brooklyn, New York 11210. Positions open until filled.

Brooklyn College, CUNY, is an affirmative action/

Senior Faculty Position: Meteorology. Applications and nominations are invited for a sen-ior faculty position in meteorology, at the University of Utah. Eligible applicant will also be considered for chairperson of the department. Candidates mus possess a Ph.D. in meteorology or a related discipline. Applicants should have teaching and re-search experience and be interested in participa in both the graduate and undergraduate programs. Applicants should submit curriculum vitae and names of three professional references to:

Dr. Jan Paegle Search Com Department of Meteorology Sall Lake City, Utah 84112 Deadline for applications November 30, 1981. The University of Utah is an affirmative action/ equal opportunity employe

California Space Institute, University of California, Santa Barbara: Research posi tion in Remote Sensing. Basic and applied research in some combination of remote sensing of coastal zones, land use/land cover, natural and ag-ricultural vegetation, and soil moisture with skills in and quantitative modelling. We seek an indepr t worker with the goal of deepening and widen ing existing work in these areas on this campus. h.D. preferred. Rank and salary commensurat with experience. Closing date: November 30, 1981. Submit: resume: a brief account of research into sts; and names of three professional referees to Dr. David S. Simonett, Department of Geography University of California, Santa Barbara, Califo

The University of California, Santa Barbara, is an equal opportunity/Affirmative Action employer.

## **HYDROGEOLOGISTS**

Escape to Wisconsin Residuals Management Technology is a consulting firm specializing in the waste management field. Headquartered in Madison, Wisconsin, w rurrently work in more than 20 states. If you are interested in waste management challenges facing the U.S. today—interested in locating minutes way from a major university—minutes away om great fishing and outdoor recreation, then le us get to know you. Our rapid growth has creat ed openings in hydrogeology. Ideal candidates will have M.S. degree and 1-2 years experience in conducting hydrogeologic investigations and above average skills in verbal and written communications. Industrial experience a plus. Re-sponsibilities include design of field investigation program, field work, data analysis, report writing and work with industrial and public sector clients. Be a team member working with engineers, chemists, and other technical personnel on ground water poliution projects, design of solid and hazardous waste landfills, and mine waste asibility and disposal plans. To be considered reasibility and disposal plans. To be considered for these immediate openings, send a letter with salary history, professional and personal goals, and resume to Chief Hydrogeologist, David Nichols, Residuals Management Technology, 1406 E. Washington Avenue, Suite 124, Madison, Wisconsin 53703. AA/EOE.

Research Associate in Geochemistry/Uni versity of Chicago. Post-doctoral position in-volving extraction of micro-samples from meteority under clean conditions and analysis for major and trace elements by instrumental and radioche neutron activation. Goal is to investigate behavior of the elements during condensation of the solar

Experience in geological samples an asset, in meteorites a definite plus and in radiochemistry a necessity. Send vita and names of two referees to Professor Lawrence Grossman, Department of

Magnetospheric Physics

Solar & Interplanetary Physica

**Tectonophysics** 

Secretary

Shakil P. Duggal

Miriam A. Forman

Theodore A. Fritz

Leonard F. Burlaga

Bruce T. Tsurulani

Christopher Scholz

Michael Schulz

President-elect

physical Sciences and Enrico Fermi Institute, University of Chicago, Chicago, Illinois 60637. The University of Chicago is an affirmative acn/equal opportunity employer

on and reserves for mines. Hardcover,  $6 \times 9$ 

inches, 590 pages. Table of contents, drawings, in-dex, references, 1980. \$156. Tatach Associates,

Thunder Road, Sudbury, MA 01776, USA.

Coal Deposite. If you are financing, planning, exploring, drilling, or digging in connection with any form of energy, you need this complete, up-to-deta book about the world's coal deposits. Includes or

# COURSES

MSA Amphibotes Short Course. The Mineralogical Society of America will sponsor a Short Course on Amphiboles and Other Hydrous Pyriboles at the Marydale Retreat Center in Erlanger, Kentucky, October 29 to November 1, 1981, before the MSA/GSA Annual Meeting In Cincinnati, Ohio. structional Staff will be

J. B. Thompson, Jr. (Harvard)—Polysomalism

and polytypism in pyriboles

- F. C. Hawthorne (Manitoba)—Crystal chamis-
- try of amphiboles S. Ghose (Univ. Washington)—Subsolidus re-
- P. Robinson (Univ. Massachusetts)-Amphiboles of metamorphic rocks
- M. C. Gilbert (VPI)-Phase equilibris and amphiboles of igneous rocks
- D. R. Veblen (Johns Hopkins) (Convenor and r)—Wide-chain pryiboles
- T. Zoltai (Univ. Minnesota)—Mineralogy of am-M. Ross (USGS)—Geological occurrence of

amphibole asbestos Contact: MSA, 2000 Florida Avenue, N.W., Wash-Ington, D.C. 20009. Telephone: 202/462-6913. Registration Deadline: October 1, 1981.

#### STUDENT OPPORTUNITIES

earch-Cum-Teaching Assistance Ships. Available in Space Physics and Atmospheric Science Programs. Stipend during academic year is \$777 per month and twice this rate during er. Write to: G. G. Sivjee, Head Space Phys ics and Atmospheric Science Program, Geoph Institute, University of Alaska, Fairbanks, AK 99701 or call (907) 479-7058.

Graduate Research Assistantships in Civil neering. The Department of Civil Engine ing at Princeton University invites applications for uate study and research in the areas of structures and mechanics, transportation, water resources and engineering management systems leading to M.S.E. and Ph.D. degrees. Including tion, annual research stipends range from \$14,000 to \$15,000 and are offered to all admitted students requesting support. For details and application rrite: Ahmet S. Cakmak, Director of Graduale Studies, Department of Civil Engineering, Princetor University, Princeton, NJ 08544.

Graduate Study in Space Physics and Attronomy. Rice University is pleased to offer Fellowships for entering graduate students in the Department of Space Physics and Astronomy. Exciting research is underway in the fields of theoretical and experimental space plasma physics, magne apheres of the earth and planets, atmo: ionospheric physics, laboratory studies of Rydberg atoms, laser research, space solar power studies,

and astronomy and astrophysics.

The fellowships for first year students present are \$4545 taxfree for 9 months, plus tuition, and in volve only 4-5 hours tutoring, grading, or instructing per week for four semesters. Research assiseahips for summers and subsequent years are generally available at \$550 per month. Students ith exceptional undergraduate records and GRE scores are eligible for an additional \$1000 Pres dential Recognition Award. Raises are expected to

Address inquiries to: Dr. Patricia Reiff, Assistant Chairman, Department of Space Physics and Astronomy, Rice University, 77001.

lassor of earth sciences, Dartmouth Col-1998. Major Interests: solid earth geophysics and lectonics. B.S.E. in geological engine Mg, Princeton, 1948; Ph.D. In geology, Cohia, 1958. Columbia faculty until 1969, at hal time professor and chairman; Department of Geology, Dartmouth College since 1969. Fellow: AGU, GSA, AAAS, RAS; member AAPG, SEXG, SSA, Sigma XI, MTS, AGID. Has been president GSA, on council of AAAS, on research committee of AAPG, ongoverning board of AGI. Served on many es, chaired Office of Earth Sciences, U.S. Geodynamics Committee, Comtillee Advisory to ESSA (NOAA), Panel on Gas Reserve Estimates, U.S. National Commilities on Geology, Geophysics Study Committee, all of NAS-NRC. Past president, inunion Commission on Geodynamics, ICSU: 75 publications, 14 printed by AGU. hed Lecturer: AAAS, AAPG: Honovery Member, Geological Society of France. Served as member of AGU Committee on Intemational Participation; coeditor AGU Monograph 12; editor, Geodynamics: Progress and Prospects.



M. Gordon Wolman. Age 56 and a nember of the American Geophysical Union since 1954. He is a professor of geography nd chairman of the Department of Geograby and Environmental Engineering of The bins Honkins University. His areas of scientific interest are geomorphology, in particukr. alluviai morphology, hydrology, sedimen talion, water quality, and the relationship of natural surficial processes to alterations of the environment by man. He received his B.A. (1949) from The Johns Hopkins University, M.S. (1951), and Ph.D. (1953) in geolowhom Harvard University, From 1953 to 1958, Wolman worked with the Water Resources Division of the U.S. Geological Sursy. Appointed in 1958 to Johns Hopkins, his esearch includes studies of urban river sysems, energy and environment, and environmental quality policy. He was a councilor of the Geological Society of America (1976–78) ™d American Geographical Society (1966– 70), and member of the Executive Commitee, Division of Earth Sciences (1966-68). Executive Board, University Council on Waler Resources, 1963, National Academy of Sciences Committee on Water (1965–68). NAS Environmeniai Studies Board (1974– 77), and chairman of the NAS-NAE Commit lee on Water Quality Policy (1974-76). He is currently president of the Board of Re-Sources for the Future and was recently elected a fellow of the American Academy of Aris and Sciences. He has authored or coauthored approximately 50 scientific publicalons, including a text: Leopold, Wolman, and Miler, Fluvial Processes In Geomorphology. Wolman was chairman of the AGU Subcommittee on Sedimentation (1960--62), member of the Committee on Status and Needs in diology (1964), president of the Section Hydrology (1970--72), and delegate to the IGU meeting in Moscow in 1972. He currently serves on the Membership Committee.

Geodesy: President-Elect



Byron D. Tapley. Age 48, Joined AGU in 1970. Tapley currently serves as the W. R. Woolrich Professor, Department of Aerospace Engineering and Engineering Mechanics, and as the director of the Institute for Advanced Study in Orbital Mechanics at The Inversity of Texas at Austin. His research Interests include satellite applications to geidesy, geodynamics, oceanography, and nonlinear parameter estimate theory. Cur-tently he is involved in the analysis of salelthe altimeter data and in the application of laser ranging to polar motion determination and precise point positioning as a part of NASA's Crustal Dynamics Program. He received a B.S. (1956) in M.E. and an M.S. (1958) and Ph.D. (1960) in engineering me-chanics from The University of Texas at Aus-In. He joined the U.T. aerospace engineering faculty in 1960. He served as chairman of the combined ASE-EM Department from 66-1977. He is a current member of the AGU Girding for Tomorrow (GIFT) Committee, in addition to the AGU, his society memahips include AIAA, AAAS, AAU, IEEE, lugg, IAG (Commissions 17 and 19), and COSPAR (Working Group 1). He is a tellow

of AIAA and AAAS. He served as chairman (1973) and committeeman-at-large (1974-1978) for Section M (Engineering), AAAS; and chairman (1973-1975), AIAA Technical Committee on Astrodynamics. He currently serves as committeeman, Division of Dynamical Astronomy, American Astronomical Society. He served as chairman, Region IV, ECPD Engineering Education and Accredite tion Committee from 1973 to 1975. He is the current chairman of the National Research Council, Geodesy Committee. He is an assoclate editor of AGU's Geophysical Research Letters, the Celestial Mechanics Journal, and the AIAA Journal of Guidance and Control. He has authored over 70 articles in refereed journals and over 70 chapters, reports, or sections in conference proceedings and edited three conference proceedings. Tapley is a member of the NASA Ocean Topography Experiment (TOPEX) Science Working Group and the GRAVSAT User's Working



Petr Vaniček. Member since 1970; age 45. Professor of geodesy, University of Toronto (Erindale College) and University of New Brunswick, Fredericton. Current research interests: geodynamics, earth gravity field, mathematical techniques of geo application of statistics in geodesy, applications of extraterrestrial methods to geodesy physical oceanography, theoretical elasticity. eived dipl. ing. degree in geodesy (1959) in Czech Technical University in Prague and Ph.D. in mathematical physics (1968) in Czechoslovak Academy of Sciences in Prague. Worked as a surveyor at Prague Institute of Surveying and Cartography (1959-1963), consultant in numerical analysis and computer applications at Faculty of Technical and Nuclear Physics of Czech Technical University (1963-1967), research fellow and later senior scientific officer at institute of Oceanography, Bidston, U.K. (1967-1969), NRC of Canada postdoctorate fellow in Surveys and Mapping Branch of EMR, Otlawa (1969-1971), associate and full professor of geodesy at UNB (1971-1981), visiting scienlist. USGS Center for Earthquake Research, Menlo Park, California (1977). Member of executive CGU, fellow of GAC, Sigma XI, member of CIS. NYAS, SVU, member of Canadlan National Committee for IUGG. Author of 110 books and papers, including three papers in Eos (e.g., 'The Map of Contemporary sional societies. Vertical Crustal Movements In Canada, coauthor D. Nagy) and one in Reviews of Geophysics and Space Physics ('Geodetic level-Geomagnetism and ling and its applications, coauthored by R. O. Castle and E. I. Balazs). Coeditor of Manuscripta Geodaetica. Member of IAG working Elect groups 1:21, 1:41, 4:80, 5:63, Canadian rep resentative on IUGG Commission on Re-Crustal Movements. Honours Include: NERC

# served on AGU GMP Committee

Geodesy: Secretary

(U.K.) Senior Research Fellowship (1967-

ship (1969-1971), CNPq (Brazii) Visiting

NRC (U.S.A.) Senior Visiting Scientist

1969), NRC (Canada) Postdoctorate Fellow

(1978), University of Stuttgart (W. Germany

Visiting Professorship (summer 1981), Uni-

versity of São Paulo (Brazil) Visiting Profes-

sorship (summer 1981). Since 1978 has

orships (summers 1975, 76, 79),



John D. Bossier. Age 44, joined the American Geophysical Union in 1972 and is currently employed with the Department of Commerce, NOAA, Rockville, Md. His scientific interests are in geophysics and geodetic science, with degrees from the University of Pittsburgh, B.S. (1959) and Ohlo State University, M.S. (1984), Ph.D. (1972). Profesalonal experience; chief, eaironomic geodetic field parties and other mobile field party units, where he received training in all phases of geodetic operations; candidate for two full-time university training assignments at OSU, developed mathematical formulas and computer programs to support World-wide Satellite Triangulation Network of NOAA, Rockville, Md., served as project manager for the readjustment of the North American Datum, served concurrently as project manager and deputy director, National Geodetto Survey, Department of Com-merce, NOAA, Rockville, Md. He is secre-

tary, Geodesy Section, AGU; vice chairman, ASCE, Surveying and Mapping Division; member, IUGG, IAG, Special Study Group 5.39; president, Subcommission for North America of Commission X, IAG; secretary of Section I of the IAG; member, Board of Direction, ACSM; and associate editor, JGR, AGU. He has authored 30 publications. Some examples are: 'Optimal Design of Geodetic Nets, Journal of Geophysical Research, 'Man's Geophysical Environmen Its Study from Space, a report to the admiri-Istrator of ESSA. Honors: National Honorary Engineers Fraternity, Sigma Tau; two Heiskanen Awards from OSU for eminence in the field of geodetic science, and several letters mendation for accomplishments in his



Robert F. Brammer. AGU member, 1977. Born in Washington, D.C., 1946. Currently, director of the Physical Sciences Division at TASC, managing 50 professionals and several programs in geodesy, geomag netism, oceanography, and hydrologic fore-casting. His geodesy work includes principal aligator studies for both the GEOS-3 and SEASAT altimeters (high-resolution geolds and seamount detection), the design and development of a new computer system for the DoD Gravity Library, and analysos of gravity effects on satellite and strategic systems. Other scientific interests include satellite oceanography and geomagnetism. He is a principal investigator for MAGSAT, develop ing signal processing methods for magnetic anomaly mapping and for tectonic interpreta tion, using both MAGSAT and satellite altim eter data. Brammer received a B.S. from the University of Michigan in 1968 and an M.A. and Ph.D. from the University of Maryland in 1970 and 1972, respectively. Before joining TASC, he was with NASA GSFC working on Apollo and Skylab. He is also a member of the SEG, the AMS, SIAM, and the IEEE. He has published more than a dozen technical papers, including GEOS-3 results in JGR and SEASAT results in Geophysics Research Letters. He is a member of Phi Beta Kappa, Phi Kappa Phi, a Woodrow Wilson Fellow, and a recipient of three National Science Foundation grants for research in mathmatics. Currently, he is serving as chairman of the External Liesson Committee for the Geodesy Section of the AGU, arranging for laint conference sessions with other profes

Paleomagnetism: President-



Oxford, England, in 1938; he has been a member of AGU since 1965. He is presently professor and chairman of the Division of Marine Geology and Geophysics at the School of Marine and Atmospheric Science, University of Miami, where he has been since 1967. His research interests include paleomagnetism and its application to the study of plate motions and paleoclimatology field (JGR 85, p. 3511). He is also interested in marine magnetic anomalies and their sources (JGR 75, p. 2033) and is currently investigating long-wavelength magnetic anomalies recorded by MAGSAT. He has also studied reversals of the earth's magnet ic field (*Nature*, 204, p. 566). He obtained a B.A. from Cambridge University in 1960, majoring in physics, and a Ph.D. from the Deiment of Geodesy and Geophysics in the same university in 1984. From 1961 to 1967 he was a postgraduate research geophysicist at the Scripps Institution of Oceanography, University of California. He is a member of AAAS and a fellow of the Royal Astronomica Society. He was recently a member of the Publications Study Committee for the Geo-logical Society of America. He has authored or coauthored over 70 papers, of which about a quarter have been published in AGU journals, and he has been author or coauthor of more than 30 papers presented at AGU neetings. Harrison was an associate editor of JGR from 1973 to 1975 and was geomagnetism and paleomagnetism member on the Spring Meeting Program Committee for 1977 and 1978. He was chairman of the AGU

Christopher G. A. Harrison. Born in

Publications Committee from 1978 to 1980. He is currently chairman of the AGU Budget and Finance Committee



American Geophysical Union in 1959. He is presently chairman of the Department of Geology. The University of Florida, Gainesville, Florida. Opdyke's research interests have been in paleomagnetism and its applicat to tectonic and stratigraphic problems. He has also been interested in paleoclimatology He received his B.A. degree from Columbia College in 1955 and his Ph.D. in 1958 from Durham University, U.K. He held postdoctor al fellowships at Rice University in 1958-59. The Australian National University in 1960-61. The University of Rhodesia and Nyasaland in 1961-63. He has been a member of the staff at Lamont-Doherty Geological Observatory from 1984 to 1981, where he served successively as research associate, senior research associate, adjunct professor. and interim director. Opdyke is a fellow of the American Association for the Advancement of Science and the Geological Society of America, where he served as chairman of the Geophysics Section in 1979-80. He is the author or coauthor of 100 scientific papers. He became a fellow of the American Geophysical Union in 1976 and served on the Committee of Fellows and as chairman of the Boucher Awards Committee. He also served as program chairman for the GP section in 1979-80 and as associate editor for the AGU Bullelin in 1978-80.

Nell D. Opdyke. Age 48; joined the

Geomagnetism and Paleomagnetism: Secretary



Ronald T. Merrill. Age 43. a member of AGU since 1964. He received his B.S. and M.S. degrees in mathematics from the University of Michigan In 1959 and 1961, respectively. He received his Ph.D. degree in geophysics from the University of California at Berketey in 1967. Merrill is currently a prolessor in geophysics and oceanography at the University of Washington in Seattle. He has also held visiting faculty appointments at the Research School of Earth Sciences at the Australian National University in 1974, 1976, and 1978. In 1982 he will become a professor of geophysics and geological sci ences at the University of Washington, and he will apend a few months as a visiting faculty member at the Australian National University. He was associate editor of the red JGR from 1978 to 1981. In addition, he has also been an associate editor for the Quaternary Research Journal and a guest assoclate editor for the Physics of Earth and Planetary Interiors. Merrill has served on the Lunar Science Review Panel and the Lunar and Planetary Science Review Panel. He has authored or coauthored over 30 scientific articles, mostly in geomagnetism, including nine articles in JGR and three in the Reviews of Geophysics and Space Physics, Merrill's current research is primarily in rock magnetism and paleomagnatism. He is also working on a book, to be coauthored with M. W. McEininny, on the history and origin of the earth's magnetic field.



Maureen B. Steiner. Age 36; a member of AGU since 1970. She is employed as a research scientist in the University of Wyoming Department of Geology and Geophysics. Her areas of interest include geomagnetto field reversal history and mechanisms. plate motions, origins of sedimentary remanent magnetization, mineralogy of iron oxides and the effects of maghemitization on oceanic basalt magnetization. She holds a 8.S. (1966) and M.S. (1967) from Southern lethodist University and a Ph.D. (1974) from the University of Texas at Dallas. Steiner has been employed in several research science.

# AGU

# Nominations for Officers 1982-1984

The following nominces were presented by the Union and section nominating committees and were accepted by the Council:

# Union

President-elect Charles L. Drake M. Gordon Wolman

# Sections

President-elect Secretary Geodesv

Byron D. Tapley John D. Bossler Petr Vaniček Robert F. Brammer

Geomagnetism Paleomagnetism Christopher G. A. Harrison Ronald T. Merrill

P. Allen Freeze Donald R. Nielson

Neil D. Opdyka

Thomas Maddock III Eric F. Wood

Maureen B. Steiner

W. Lawrence Gales

Fred D. White

Meteorology

Ronald L. Lavole Ronald C. Taylor

J. Dungan Smith

**Oceanography** Donald V. Hansen Peter G. Brewe Joseph L. Reid

Planelology

Leurence A. Soderblorn Thomas B. McCord David W. Strangway Joseph F. Veverka

Michael A. Chinnery Thomas H. Jordan Robert B. Smith Lynn R. Sykes

Solar-Plenetary Relationships George C. Reid Christopher T. Russell

Aeronomy

J. R. Doupnik Playmond G. Poble:

Thomas J. Ahrens

Volcanology, Geochemistry, and Petrology G. Brent Dairymple J. Lawford Anderson Heinrich D. Holland Peter W, Lipman

Members of AGU are invited to submit additional nominees by petition in accordance with the bylaws. Each petition must be

signed by at least 1% of the voting members of the Union or section, as the case may be, and such petitions must be received by the General Secretary by November 30, 1981. The number of names required to make a petition nomination is as follows: Union, 131; Geodesy, 6; Geomagnetism and Paleomagnetiam, 7; Hydrology, 23; Meteorology, 10; Oceanography, 16; Planetology, 6; Selamology, 13; Solar-Planetary Relationships, 15; Tectonophysics, 11; and Volcanology, Geochemistry, and Petrology, 12.

Union: President-Elect



Charles L. Drake. A member of AGU lifice 1950; 56 years old, Dean of graduate studies, associate dean of sciences division.

#### Hydrology: President-Elect



R. Allen Freeze. Age 42; a member of the Hydrology Section of AGU since 1970. He is currently a professor in the Department of Geological Sciences and an associate dean in the Faculty of Graduate Studies at the University of British Columbia in Vancouver, Canada. He obtained his B.Sc. in geological engineering from Queens University in 1961 and his Ph.D. in civil engineering from the University of California at Berkeley In 1966. Before joining UBC, he was a research scientist with the Hydrologic Sciences Division of the Canada Inland Waters Brench in Calgary, Alberta, and a research staff member at the IBM Thomas J. Watson Research Center in Yorktown Heights, N.Y. He is the author of over 50 technical publications in the fields of hydrology, hydrogeology, soil physics, and engineering seepage. He is coauthor (with J. A. Cherry) of the textbook, Groundwater, published in 1979, in addition to AGU, he is a member of the Geological Society of America, the Canadian Geolechni cal Society, and the Association of Professional Engineers of British Columbia. Freeze was awarded the Horton Award by AGU in 1970 (with J. A. Banner) and in 1972 for his papers in Water Resources Research on The Mechanism of Natural Groundwater Recharge and Discharge' and The Role of Subsurface Flow in Generating Surface Runoff. The latter paper also resulted in the 1974 Meinzer Award from the Geological Socrety of America. Freeze received the Macelwane Award from AGU in 1972. He served as editor of Water Resources Research during the period 1976-1980.



Donald R. Nielsen. Age 49; a member of AGU since 1958. He is professor of soil and water science in the Department of Land, Air, and Water Resources, University of California, Davis. His areas of scientific interest include hydrology, water and solute behavior in the vadose zone, and soil physics. He holds B.S. (1953) and M.S. (1954) degrees from the University of Arizona and the Ph.D. (1958) from lowa State University Nielsen has been employed by the Universit of California since 1958 and has served as associate dean, director of the Kearney Foundation, and chair of Land, Air and Water Resources. He has served as a consultant for the U.S. Army, NASA, State of California eni of Water Resources, USEPA FAO IAEA, USAID, and USDA. He is presideni of the Soil Physics Commission of the international Soil Science Society, associate editor of the British Journal of Soil Science. and has served on boards of directors of the Soil Science Society of America and American Society of Agronomy. Presently, he is on the Panel of Remote Sonsing for Water Resources of the Space Applications Board of NRC and has served on panels of the Geophysics Board and on Water Resources Review Committee of the Food and Agriculture Board of the National Academy of Science. He has authored or coauthored more than 150 scientific articles and edited three books He is a follow of the Soil Science Society of America and of the American Society of Agronomy. He is also a member of Sigma Xi, Phi Kappa Phi, Gamma Sigma Daka, Phi Lambda Upsilon, and Pi Mu Epsilon. He has been a senior postdoctoral fallow of NSF and an invitational symposium speaker in more than 15 countries. Nielsan has served on Soli Moisture Program committees of AGU. and since 1970, has served as associate editor of Water Resources Research

#### Hydrology: Secretary



Thomas Maddock III. Age 42; a member of AGU since 1969. He is currently professor of hydrology and water resources al the University of Arizona and specializes in groundwater management. Maddock received an undergraduate degree from the University of Houston and his masters and Ph.D. degrees from Harvard under the Harvard Water Program. Before leaving to join academia, he worked for the U.S. Geological Survey as a member of its Water Resources Division System Analysis Group and Groundwater Branch. Maddock was an associate editor for Water Resources Research and was chairman of the AGU Hydrology Division Committee on Water Resource Systems, A member of AWRA; Sigma PI Sigma, an honorary physics society; and of the ASCE Committee for the Inverse Problem, he is currently an editor of the AGU Monograph



Eric F. Wood. Age 33; a member of AGU since 1971. He is an assistant profes sor of civil engineering and director of the Water Resources Program at Princeton University. His areas of scientific interest include stochastic hydrology, forecasting, and water resources planning and optimization. He holds a B.A.Sc. (honors; 1970) from the University of British Columbia, and S.M. (1972). C.E. (1973), and Sc.D. (1974) from the Massachusetts institute of Technology. Wood has been at Princeton since 1976. From 1974-1976 he was a research scholar at the international institute for Applied Systems Analysis (IIASA) in Laxenburg, Austria. He participated in the National Science Founda-tion working group on flood hazard miligation. Wood has authored or coauthored more than 35 scientific articles and publications and has edited one book entitled Real-Time Forecasting Control of Water Resource Systems (Pergamon, 1980). He was awarded the Horton Award for his paper 'An Analysis of the Effects of Parameter Uncertainty in Deterministic Hydrologic Models' (WRR, 12(5), 925-932). He has served on the AGU Data Network Design Committee since 1977, has been an associate editor of Water Resources Research from 1977, and is on the Millorial board of the AGU Water Resources

### Meteorology: President-Elect



W. Lawrence Gates. Age 52, a member of AGU since 1958. He is presently pro-fessor and chairman of the Department of versity and also founder and director of the OSU Climatic Research Institute. His areas of current scientific interest are climate dynamics, paleoclimatology, the general circulation, and atmospheric modeling. He holds the degrees of S.B. (1950), S.M. (1951), and Sc.D. (1955), all from the Massachusetts Institute of Technology. Gates has been employed by the Air Force Cambridge Research Laboratory (1953-57). where he directed the numerical weather prediction project; the Department of Meleorology at UCLA (1957-66), where he was assistant and then associate professor; and the Rand Corporation (1968-76), where he directed the climate program. He has been at OSU since 1976. Gates has been a member of numerous committees and panels of the American Meteorological Society, the Environmental Protection Agency, the National Aeronautics and Space Administration, the National Academy of Sciences, the University Corporation for Atmospheric Research, and the World Meteorological Organization: his present activities include membership in the Working Group on Numerical Experimentation of the WMO's World Climate Research

Mark Balling

Program and the Climate Research Committee of the National Academy of Sciences' Climate Research Board. He has authored or coauthored approximately 40 published articles of which live are in AGU journals, and he has written more than 45 other technical reports. In 1980, he was elected a fellow of the American Meteorological Society, and in 1981 he became a fellow of the American



Fred D. White. Age 63 and a member of AGU since 1960. He was elected a fellow of AGU in 1967. He is currently employed as executive secretary of the National Research Council's Committee on Atmospheric Sciences and by the American Meteorological Society as editor of its AMS NEWSLETTER. He holds an A.B. (1941) from Miami University and a Ph.D. (1963) from the University of Misconain. White served with the U.S. Air Force from 1941-1963 and is a colonal in the USAF Reserve. He worked with the U.S. Veather Bureau from 1946-1958 and with the National Science Foundation from 1958-1976. He is a member of Sigma XI; American Meteorological Society (has served on the Council, chairman of the nominating committee, and chairman of the Washington Chapter); and AAAS (has served as chairman of the Atmospheric and Hydrospheric Sciences Section and on the nominating nittee). White served on AGU Statute and By-Laws Committee from 1964-1972.

#### **Meteorology: Secretary**



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Ronald L. Lavole. Age 48; became a member of the AGU in 1982. He is director of the Atmospheric Programs Office in the National Oceanic and Atmospheric Administration's Office of Research and Development. His main areas of scientific interest are numerical modeling on the mesoscale, cloud physics, and weather modification. He re-ceived a B.A. (1954) from the University of New Hampshire, an M.S. (1956) from Florida State University, and the Ph.D. (1968) from the Pennsylvania State University. Lavole began his career as meteorologist-in-charge of the Mt. Washington Observatory in New Hampshire (1957–59). He served on the faculty of the meteorology department at the University of Hawaii, where he was also a member of the Hawaii Institute of Geophysics, from 1959 to 1988. He was an associate ics, from 1959 to 1968. He was an associate essor at Pennsylvania State University from 1968 to 1973, including a year on interntal Personnel Act assignment to the National Science Foundation as assoclate program manager for meteorology. He has been with NOAA since 1973. Lavole is a ellow of the American Meteorological Society, which he has served as chairman of the Committees on Cloud Physics, Awards, and Weather Modification. He is also a fellow of the AAAS and a member of the Weather Modification Association, Sigma XI, and Phi Bela Kappa. He serves on advisory commitless to the National Center for Atmospheric Research and the World Meteorological Organization. He has authored or cos 16 articles in journals or books and has been on program committees for several national and international conferences.



Ronald C. Taylor. Age 48; member of AGU aince 1956. National Science Foundation, Almospheric Research Section/Meteorology Program, Washington, D.C. Born, Port Huron, Michigan, 1932, B.A., 1959, Universi-ty of California, Los Angeles; Ph.D., 1988, University of Hawali, Assistant professor of maleorology, Saint Louis University, 1989 meleorology, Saint Louis University; 1968– 1969, University of Hawali, 1969; research contract, U.S. Navy Weather Research Facility, Norfolk, Virginia, 1969; graduate program in meleorology, University of Maryland, 1975. Member, AAAS, American Meteorological

Society, Meteorological Society of Japan. Tropical meteorology air-sea interaction; polar meteorology, Antarctic, synoptic, and physical. Served as secretary of the AGU prology Section 1978-1980.

## Oceanography: President-Elect



Donald V. Hansen. Age 50 and a member of AGU since 1963. He holds degrees in physics (B.S., 1954) and oceanography (M.S., 1961; Ph.D. 1964) from the Uni versity of Washington, Seattle. He served on active duty in USAR as meteorological office and artillery officer during 1954-56. He subsequently worked as an engineer in testing and evaluation for Boeing Airplane Company and as a science teacher with the Seattle public schools. Following his graduate education he held a position as research assistant professor at the University of Washington before accepting a position as research oceanographer with the U.S. Department of Commerce. He has been director of the Physical Oceanography Laboratory, Atlantic Oceanographic and Meteorological Laboratories (AOML) since 1969, and additionally was acting director, AOML, during 1978-80 He is a member also of Sigma Xi, ASLO, AAAS, Florida Academy of Science, and In ternational Oceanographic Foundation and holds an adjunct faculty appointment at the University of Miami. Hansen has over 40 publications in oceanography, two of which appeared in AGU journals, and has made numerous presentations at and chaired scientific sessions at the AGU meetings. He has received NOAA awards for distinguished scientific authorship in 1971, 1975, 1977, and 1980. He has also received other NOAA awards. He served as associate editor, Journal of Geophysical Research, during 1986-68, and is presently a member of the AGU Committee on Coastal and Estuarine Re-



Joseph L. Reid. Age 58; B.A., University of Texas (1942), M.S., Scripps (1951); a member of AGU since 1950 and a fellow since 1975. Professor of physical oceanography at the Scripps Institution of Oceanography, where he has worked since 1951. He served as president of the Oceanograph Section of AGU 1972-1974 and on the Fellows Committee 1979–1980. He has authored or coauthored over 50 articles in the refereed journals (13 in AGU publications and he has served as associate editor to several journals, edited several books, and contributed several reviews. His area of interest is the circulation of the world ocean the characteristics of the waters and the areas and manner of their formation. He has carried out several oceanographic expeditions in the Pacific, Antarctic, and Atlantic oceans, including a study of the Northwestern Pacific, Bering and Okhotsk seas in Jan-uary-March 1988. In 1955 he proposed and coordinated the NORPAC Expedition, a program for collecting oceanographic observations over the entire North Pacific north of 20°N and carried out by 19 ships of the Unitthe originators of the GEOSECS expedition He has served on various advisory panels to N.S.F. and other federal agencies, and S.C.O.R. He is a member of A.S.L.O. and A.A.A.S. Representative publication: 1981, On the Mid-Depth Circulation of the World Ocean, Chapter 3, In Evolution of Physical Oceanography (B. A. Warren and C. Wunsch, editors), The MIT Press, pp. 70-

# Oceanography: Secretary



Peter George Brewer. A senior sol entist in the Chemical Oceanography Depart ment at the Woods Hole Oceanographic in-

titulion, he has been a member of the merican Geophysical Union since 1979. Rom in December 1940, he earned both his undergraduate and graduate degrees at Liv-encol University, England, in 1982 and 967, respectively. He came to WHOI as an usistant scientiat in 1967, was appointed an iale scientist in 1971, and a senior scimust in 1978. His professional activities indule memberships in the American Chemial Society, the Geochemical Society, the merican Association for the Advancement of Science, and the American Geophysical

His scientific interests include the analytiistry of seawater, trace element istry, the chemistry of marine particvale matter, the physical properties of seawater, and the oceanic carbon dioxide systen. Amorig his 48 publications and nine schrikal reports are the following: Brewe P.G. and A. Bradshaw, 1975, The effect of non-kleal composition of seawater on salinity and density, J. Mar. Ros., 33, 157-175; Brewer, P. G., 1978, Direct observation of the oceanic CO<sub>2</sub> increase, *Geophys. Res.* [et., 5, 997-1000; Brewer, P. G., Y. Nozaki, p.W. Spencer, and A. P. Fleer, 1980, Sediment trap experiments in the deep North At-tantic isotopic and elemental fluxes, J. Mar. 83, 38(4), 703-728; Balistrieri, L., P. G. Brewer, and J. W. Murray, 1980, Scavenging ience times of trace metals and surface demistry of sinking particles in the deep coan, Deep-Sea Fles., submitted.



J. Dungan Smith. Age 42; professor nand chairman of the Geophysics Program athe University of Washington, also profeswin the Departments of Oceanography and ological Sciences, joined AGU in 1965. Scenific interests: estuarine and coastal physical oceanography, turbulent boundary layer mechanics, physics of marine and fluvi a sediment transport. B.A. and M.S. in geoloy from Brown University, 1962, 1963; PhD. In geophysical fluid mechanics from University of Chicago, 1968. Employed at University of Washington 1967-present. Vember of AGU, AAAS, Sigma XI, IAHR. Twenty-two scientific papers, e.g., (1) Modelof sediment transport on continental shelves, (2) Measurements of the turbulent toundary layer under pack Ice, (3) Time-dependent mixing in a salt wedge estuary, and (4) Tidal interaction of stratified flow with a sillin Knight Inlet. Four papers in JGR, e.g., Stability of a sand bed aubjected to a shear flow of low Froude number, (2) Spaly averaged flow over a wavy surface, and 3) Turbulence measurements in the bounday layer over a sand wave field. Recent Piore: Senior Queen's Fellowship in Marine idences (Australia); Service in AGU: past sociate editor of JGR.

#### <sup>Pianet</sup>ology: President-Elect



Laurence A. Soderbiom. Currently the of the Branch of Astrogeologic Studies of the United States Geological Survey. ed New Mexico Institute of Mining and ology, receiving bachelor's degrees in geology and physics. He then entered allech and received a Ph.D. in planetary science and geophysics. Since joining the Branch of Astrogeologic Studies in 1970, Lary has been engaged in a broad spectrum il Manelary research tasks, including theoreical modeling of planetary surface processes, telescopio instrument development and observations, determination of the global time scales and evolutionary sequences for the crusts of the terrestrial planets, establishment of an advanced computer-image-proceasing lacility geared toward planetary and lenestrial geologic applications, and making gobal maps of surface materials on the terleskial planets based on various remole lenging data acquired by ground-based and craft systems. Larry has participated in MASA's unmanned space exploramissions, including Mariner 6, 7, and 9 nd the Viking mission to Mars. Gurrently he the deputy team leader for the Voyager haging Science Experiment that was reconsible for the spectacularly successful encounters with Jupiter, including discovery ol active volcanos on lo.



to the Geological Survey of Canada.

Society of Exploration Geophysicists.

SEG Virgil Kauffman gold medal; was elect-

ed to the Royal Society of Canada in 1974:

and is an honorary member of the Canadian

number of journals and has been president

Geophysical Union (1977/79) and the Ontar-

American Geophysical Union, the Society of

Exploration Geophysicists, and the Canadian Exploration Geophysicists (KEGS) and is

currently the secretary of AGU's Planetology

He has authored or coauthored one book

and over 100 papers dealing with magnetic and electrical methods as applied to geologic

cal problems. These range from studies of

lunar samples and meteorites to planetary

sounding, and methods for waste disposal.

Thomas B. McCord. Age 42; a member of the American Geophysical Union since 1965. He was elected a fellow of AGU in

1975. He is professor of planetary sciences

at the University of Hawaii and head of the

Planetary Geosciences Division of the Ha-

for research scientist of the Massachusetts

institute of Technology. His areas of scien-

tific interests include the structure and com-

position of planetary surfaces, including the

holds a B.A. in physics (1964) from Per

earth, using remote sensing techniques. He

State University, M.S. in geology (1966) and

(1968). McCord was a professor of planetary

physics in the Department of Earth and Plan-

Ph.D. in planetary sciences and astronomy from the California Institute of Technology

etary Solence at MIT from 1968 to 1976,

when he resigned. He was chairman of the

Division of Planetary Science of the Ameri-

can Astronomical Society, 1980, and he is

now past chairman. He is a fellow of the AAAS and is a member of a wide variety of

government and NAS advising committees

150 scientific articles, including 10 in the

past year. He acte as a part-time science

sociated with research.

etles. He is and has been a member of many

and maintains an interest in national science

policy and the health of research capability in the physical eciences. He has published over

correspondent for a local TV station and co-

hosts a weekly radio show designed to com-municate the excitement and knowledge as-

ional scientific and engineering soci-

wall institute of Geophysics. He also is sen-

evolution, exploration geophysics, crustat

Planetology: Secretary

o Geoscience Research Fund. He has taken

of the Geological Association of Canada

(1978/79) and chairman of the Canadian

an active involvement in the affairs of the

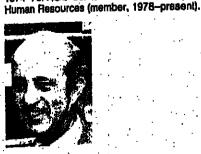
He has served on the editorial boards of a

David W. Strangway. A member of Joseph Veverka. Age 40; a member of the AGU since 1976. He is an associate AGU since 1960, he is currently vice president and provost of the University of Toron professor of astronomy at Cornell, a membe to. He obtained his B.A., M.A., and Ph.D. in of the university's Laboratory for Planetary Studies, and the director of the Spacecraft 1956, 1958, and 1960, respectively, from the University of Toronto. His work was on the Planetary imaging Facility. His areas of sci-entific interest include planetary surfaces and magnetic properties of Precambrian rocks. He spent the summers from 1952 to 1956 atmospheres, photometry, and the small vorking for mining and petroleum companie bodies of our solar system. He holds B.Sc. in exploration geophysics. The year 1956/57 was spent as chief geophysicist for Ventures (1964) and M.Sc. (1965) degrees from Queen's University (Kingston), and M.A. Lid. and 1960/61 as a research geophysicis (1970) and Ph.D. (1970) degrees from Harfor the Bear Creek Mining Company (Kennevard. He is the chalman of NASA's Comet cott Copper Corporation). He has been on the faculty of the University of Colorado (ge Science Working Group, concerned with the exploration of Halley's comet on its return in 1986, and a member of other space science ology, 1961-1964), MIT (geophysics, 1965-1968), and University of Toronto (physics, advisory groups. In addition to the AGU he belongs to the American Astronomical Socie-1968-present, and geology, 1972-present as well as a visiting professor at the University of Houston (1971-1973), From 1970ty, the Royal Astronomical Society of Canat, the International Astronomical Union, and 1973 he was at the Manned Spacecraft Centhe Meteoritical Society. He is a member of ter in Houston. Texas, where he headed up the Voyager and Gallieo Imaging Science teams and has previously participated as an imaging science investigator in the Mariner 9 and Viking missions to Mars. In 1979 he was the geophysics branch and, later, the Planelary and Earth Sciences Division. He served for a short period as the director of the Lunar Science institute and was the first chairman awarded NASA's Medal for Exceptional Sciof the Lunar Science Council of the Universientific Achievement for his investigations of ties Space Research Associates. He has the moons of Mars. He is the author or conuserved on a variety of committees dealing thor of more than a hundred scientific pawith lunar and planetary science and on a pers. Veverka currently serves on the editorinumber of visiting committees, including one al board of Icarus and is an associate editor He has been awarded the NASA medal for Exceptional Scientific Achievement and the

#### Seismology: President-Elect



Michael A. Chinnery. Joined AGU 1961. Age. 47. Current position: leader, Apolled Seismology Group, Lincoln Laboratory MIT. Research interests: seismology, seismi discrimination, seismic data management systems, seismic risk, New England earthquakes, earthquake mechanism, fault mechanics, polar motion, space geodesy, geo dynamics. Degrees: B.A. (Cambridge, 1957). M.A. (Toronto, 1959), M.A. (Cambridge, 1961), Ph.D. (Toronto, 1962), D.Sc. (Cambridge, 1977). Employment: Dep. of Geophys., University of B.C. (assistant prolessor, 1962-65); Dep. of Earth and Planet Scl., MIT (research associate, 1965-66); Dep. of Geol. Sci., Brown University (assoclate professor, professor, 1966-73); Lincoln Laboratory, MIT (1973-present). Memberships: Seismological Society of America; Eastern Section, Seismological Society of America (chairman, 1973–75; Executive Committee, 1975–77); Royal Astronomical Society (Fellow); and others. NASA: Earth Dynamics Advisory Subcommittee (chairman, 1977-78); Geology/Geodynamics Advi sory Subcommittee (chairman, 1978-81); Space and Terrestrial Applications Advisory
Committee (member, 1978–81). NAS/NRC:
GRB/GSC Study on Geophysical Data Policy
(chairman, 1979–present); member of various panels and working groups. IUGG/IUGS:
working groups to formulate contractmemics working group to formulate postgeodynamics program, 1978. ICL: coordinating commit on data centers and data exchange (chairman, 1981-present). ICSU: panel on world data centers (solid earth repres AGU journals), plus numerous abstracts, reviews, and reports, includes early work in seismic risk in eastern U.S., saturation of magnitude scale. Secretary, AGU Tectonovalca section, 1968-70. Secretary, AGU ology section, 1980-82. Program chairman, Tectonophysics, 1969 and 1970 AGU Spring Meelings. Associate editor, JGR, 1969-72. Associate editor, GRL.



Lynn R. Sykes. A member of AGU since 1961, he is 43 years of age. Sykes is currently Higgins Professor of Geological Sciences at Columbia University and head of the Seismology Group at Lamont-Doherty

1974-76. AGU Committee on Education and

Geological Observatory. He received his B.S. and M.S. at the Massachusetts Institute of Technology in 1960 and his Ph.D. from Columbla University In 1965. He was a research assistant (1961-64) and research associate in seismology (1964–66) at Lamont-Doherty Geological Observatory. Last employed in the Earth Sciences Laboratories, Environmental Science Services Administration of the Department of Commerce and adjunct assistant professor of declocy at Columbia University from 1966 to 1968. He is a member of the U.S. National Academy of Science, The American Academy of Arts and Sciences, and is a fellow of AGU, AAAS, Geological Society of America, and the Royal Astronomical Society. He has published 73 articles, a total of 30 in AGU journals. The most important recent articles are 1978, "Earthquakes, faults, and nuclear power plants in southern New York-northern New Jersey," and 1978, "Intraplate seismicity, reactivation of preexisting zones of weakness, alkaline magmatism, and other tectonics postdating continental separation;" 1980, Rupture zones of great earthquakes, Alaska-Aleutian arc, 1784-1980;" and 1981, "Repeal times of great earthquakes along simple plate boundaries." His 1967-8 & 9 papers are his three most important contributions (1967, "Mechanism of earthquakes and nature of faulting on the midoceanic ridges," J. Geophys. Ros., 72; 1968, "Selsmology and the new global tectonics," with B. L. isacks and J. Oliver, J. Geophys. Res., 73, 1969, Tectonics of the Caribbean and Middle America regions from focal mechanisms and seismicity," with P. Moinar, *Bull. Gool. Soc. Am.*). He was a recipient of AGU Macelwane and Bucher awards and is a Sloan Fellow. He has served as president of the Section of Teclonics (1972-74), as an associate editor of JGR, and on the Publications Committee. His present areas of interest include earthquake prediction and the tectonics of Alaska, the Caribbean, and the eastern United

## Seismology: Secretary



Thomas H. Jordan. Joined AGU in 1969. He is 32 years old and currently an associate professor of geophysics at the Scripps Institution of Oceanography, University of California, San Diego. Jordan's primany research interests are in the fields of seismology and tectonics; much of his work has been almed at elucidating dynamical processes within the earth by the seismological study of Earth structure. He received his B.S. (1969) and Ph.D. (1972) degrees from the California Institute of Technology and was on the faculty of Princeton University for 3 years before moving to Scripps in 1975. He has authored 40 scientific publications (including 14 in AGU journals) and was recently awarded an Alfred P. Stoan Fellowship. He is a member of the AGU Meeting Committee and an associate editor of JGR. His recent publications include: Structural geology of the Earth's interior, Proc. Nat. Acad. Sci. USA, 76, 4192-4200, 1979; The deep structure of the continents, Sci. Am., 240, 92-107, 1979; A procedure for estimating lateral variations from low-frequency eige cira data, Geophys. J. R. Astron. Soc. 52, 441-445, 1978; and Lithospheric slab penetration into the lower mantle beneath the Sea of Okhotsk, J. Geophys., 43, 473-496, 1977.



Robert B. Smith. A member of AGU since 1967, he is 42 years old. He is currently professor of geophysics and director of seismograph stations. Department of Geology and Geophysics, University of Utah. His areas of scientific interest are theory and methods in evaluation of earthquake hazards and leasibility of earthquake prediction in continental zones of intraplate seismicity, ong-time sesmic profiling using refraction and wide-engle reliection techniques for crustal structure, and kinematics and quantilative models of interplate tectonics in continental regions, including seismic evaluation of mechanics of mountain building and implacement of magmas. He received his B.S. and M.S. from Utah State University in 1980 and 1965, respectively, and his Ph.D. in 1967 from the University of Utah. He was geodelics and geophysics officer in the U.S. Air Force, 1961-64; U.S. exchange scientist

# Solar Planetary Relationships:



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George C. Reld, Born in Edinburgh, Sculland, in September 1929 and was educated at Edinburgh University, graduating In 1950 with a first-class honors degree in physics and in 1954 with a Ph D, in nuclear physics. Following a year's postdoctoral fellowship at the National Research Council of Canada, in Ottawa, he joined the stalf of the Canadian Defense Rosearch Telecommunications Establishment, where he slayed until 1963, with a 2-year broak as associate professor of geophysics at the University of Alaska in Fairbanks in 1958–60. In 1963 he joined the Commerce Department Laboratories in Boulder, Colorado, where he has remained until now. He is presently deputy director of the Aeronomy Laboratory of NOAA, and he has also held a position as one of the initial Fellows of the Cooperative Institute for Research in the Environmental Sciences at the University of Colorado (1968-73).

His research interests and contributions have ranged from studies of the acceleration and propagation of solar protons, through magnetospheric, auroral, and tonospheric plasma physics, to investigations of the ion chemistry of the lower ionosphere. Most recently he has been involved in studies of the effects of changing solar radiation on global climate. He served as editor of the Journal of Geophysical Research (Space Physics) from 1973 to 1977 and was elected a Fellow of the AGU in 1977. He is a member of the National Academy's Committee on Solar-Terrestrial Research and chairman of their Panel on the Middle Atmosphere Program.



C. T. Russell. A research geophysicis with the Institute of Goophysics and Planetary Physics at the University of California, Los Angeles. His principal research Interests are terrestrial and planetary magnetism and solar terrestrial relations, and in pursuing such interests he is heavily involved in NASA's spaceflight program—being principal investigator on both the International Sun Earth Explorer and Pioneer Venus Orbiter missions and an interdisciplinary scientiat on the Galleo mission to Jupiter. He is a recipient of the Macelwane Award (1977) and a . fellow of both the AGU and the AAAS. He is a member of the executive committee of commission D of COSPAR on Space Plasmas in the Solar System; a member of the COSPAR panel on Potentially Environmen tally Dolrimental Activities in Space, chairman of the IAGA Working Group on the Autoral Oval and its Extension into Space. chairman of the URSi Working Group on Aclive Experiments, a member of the executive committee of USNC/URSI Commission H. a member of the European Geophysical Society, the American Association for the Advancement of Science, and an affiliate member of the DPS of the AAS, and of course a long-time member of the AGU. Among the various advisory committees he serves on the Space Science Advisory Committee of NASA.

He has served the AGU in many capacilies. He was associate editor of JGR from 1976-1978, of GRL from 1979-1981, and of Eas from 1979-1982. He is AGU's representative to the U.S. National Committee of URSI. He has served on the Education and Human Resources Committee from 1977present and is presently the chairman of that committee. He is a frequent user of AGU services. He has authored or coauthored over 100 articles in AGU journals, including JGR, GRL, RSGP, and Eos, and he has authored or coauthored over 150 invited and contributed talks at the spring and fall annual meetings. Finally, he has attended every Spring and Fall AGU Meeting since 1966, with the exception of the December 1979 meeting when he was at the simultaneous IUGG assembly in Australia.

#### SPR Aeronomy: Secretary

Joe R. Doupnik. Age 43; member of AGU since 1985. He is currently with the Department of Electrical Engineering at the Utoh State University. Prior to that he did his undergraduate work at Duke University and his graduate work at Pennsylvania State University where he received his Ph.D.



Raymond G. Roble. He has been a member of the AGU since 1969, is 46 years old, and is currently a senior scientist at the National Center for Atmospheric Research (NCAR). B.S.E., 1957; M.S.E., 1961; and Ph.D. (aeronomy) in 1969, all from the University of Michigan; 1957-1960, Engineer Officor, U.S. Navy, 1961-1964, engineer at the Bendix Research Laboratories; 1969-1970, postdoctoral fellow in the Advanced Study Program at NCAR; 1970-present, scientist at NCAR; lecturer, Department of Astrogeophysics, University of Colorado, 1978-present. Current research interests include thermospheric dynamics, lonospheric chemistry and dynamic interactions; thermospheric and mesospheric aeronomy; global atmospheric electricity; auroral processes: 86 scientific papers published, 39 published in AGU journals. Outstanding Publication Award, NCAR. 1980; guest investigator for the Atmospheric Explorer satellite team, theoretical Investigator for the Dynamics Explorer satellite team, member of the National Academy of Sciences' Geophysics Study Committee and Committee on Solar and Space Physics, member of various other NASA, URSI, and NAS panels and working groups, member AGU Subcommittee for Publicity, 1977-present, associate editor, blue JGR, 1979-1982.

# SPR Cosmic Rays: Secretary



1961, he is 49 years old. He received his B.S. and his M.S. at St. Stephen's College and Delhi University in 1951 and 1953, respectively, and his Ph.D. in physics from Gujrat University, India, in 1959. He is currently with the Bartol Research Foundation of the Franklin Institute of the University of Delaware. Working the the area of cosmic ray research, he began there in 1960, became assistant professor in 1967, associate prolessor in 1973, and professor in 1978. Prior to that he was a senior research fellow at the Physical Research Laboratory in India (1959-60). He is a fellow of the American Physical Society, life member of the American Geophysical Union, and a member of the American Association of Physics Teachers, Sigma Xi, and AAAS. He is the author or coauthor of more than 90 papers in the area of cosmic rays physics.



Miriam Forman. Age 42; a member of the AGU since 1963. Adjunct associate professor in the Department of Earth and Space Sciences at the State University of New York, Stony Brook. Areas of scientific interest include the theory of propagation and acceleration of energetic solar and galactic particles in the helicephere, as defined by reported contemporary ground and spacecraft measurements, and of long-term variations of cosmic rays inferred from radiochemical studies of the earth, meteories, and lunar samples. Most active current interest is the theory of acceleration of particles by shocks, including the earth's bow shock, propagating interplanetary shocks, and stellar wind terminal shocks.

B.S. (1960) and M.S. (1961) degrees from University of Chicago; Ph.D. in physics from Stony Brook in 1972. Adjunct faculty at Stony Brook since 1973, supported on NASA grants. Visiting senior research scientist at the Max-Planck Institüt für Kernphyalk 1978—1979. Member of AGU, American Astronomical Society, and American Physical Society; member of the executive committee of the Cosmic Physics division of the APS 1980—1982. Published 25 papers, including 10 in AGU journals, and contributed 10 to AGU meetings.

#### SPR Magnetospheric Physics: Secretary



Theodore A. Fritz. Age 41; Joined AGU in 1962. He is a research physicist with the Space Environment Laboratory of the NOAA Environmental Research Laboratories in Boulder, Colorado. His scientific interests include magnetospheric and radiation belt physics and solar-terrestrial relationships, along with spacecraft program and instrumental aspects to carry out these studies. He received the B.S. degree in physics from Virginia Polytechnic Institute, Blacksburg, in 1981 and the M.S. and Ph.D. degrees in physics from the University of lowa, lowa City, in 1984 and 1987, respectively. He was involved in the design, fabrication,

and calibration of a number of scientific experiments flown as part of the University of lowa satellite programs, injun-3 and injun-5, and the NASA satellite program OGO-4. He was a research associate in the Department of Physics and Astronomy of the University of lowa during the school year 1967-1968. From 1968 to 1969 he was a postdoctoral ellow of the National Research Council of Canada, Ottawa, where he worked on data sets obtained simultaneously from satellites injun-3 and Alouette-1. From 1970 to 1971 he was an NRC/NAS Postdoctoral Resident Research Associate of the NASA Goddard Space Flight Center, Greenbelt, Md., where he became involved in the design, construcilon, and calibration of similar exp for the NASA/Explorer-45 and ATS-6 satellite programs. Since 1971 he has been with the NOAA Space Environment Laboratory in Boulder, Colo. He was involved in the NASAV TIROS-N space environment monitoring definition and is an investigator on experiments SEE 1 and 2 spacecraf launched in October 1977, a number of DoD programs including SCATHA, as well as the NASA/Galileo probe to Jupiter and the Swedish Viking program to be launched in the luture. During 1973 and again in the summer of 1978 he was a visiting scientist in residence at the Max-Planck Institut for Aeronomy, Lindau/Harz, Germany, and he was a member of the NASA Science Definition Working Group for the future OPEN (Origins of Plasmas in the Earth's Neighborhood) program. He has about 50 scientific publications over half of which are in the Journal of Geo-



Michael Schulz. Age 38; he joined the AGU in 1967. He is a research scientist with The Aerospace Corporation in El Segundo;

California. His scientific interests include theoretical plasma physics, magnetospheric and radiation-belt physics, solar wind, and solar terrestrial relationships. He earned his B.S. degree in physics from Michigan State University in 1964 and his Ph.D. degree, also in physics, from the Massachusetts Institute of Technology in 1967. He held an Alumni Distinguished Scholarship at MSU and a National Science Foundation Fellowship at MIT. He worked during the summers of 1964 and 1965 in the Polymers Division of the National Bureau of Standards. In 1967, Schulz became a member of the technical staff at Bell Telephone Laboratories in Murray Hill, New Jersey. He joined the Space Sciences Laboratory of The Aerospace Corporation in 1969 and continues to investigate plasma and radiation-belt dynamics. He has been a fellow of the American Physical Society since 1977 and a member since 1964. He has authored or coauthored more than 60 scientific articles that have been published in various journals and books, including about 30 in AGU publications. He also coauthored (with L. J. Lanzerotti) the monograph Particle Diffusion in the Radiation Belts (Springer, 1974). Schulz has served as referee for various journals (1969-present), as associate editor of the Journal of Geophysical Research (1976-1978), and as organizer of the Space Sciences Laboratory Seminar (1978-1979). He has served the AGU as secretary of magnetospheric physics since July 1980.

#### SPR Solar and Interplanetary Physics: Secretary



Leonard F. Burlaga. Member of AGU since 1966. Age, 42. Physicist. B.S., University of Chicago, 1960; M.S., University of Minnesota, 1962; Ph.D., University of Minnesola, 1966. Employed at NASA/Goddard Space Flight Center since 1966, initially as a National Academy of Sciences/National Research Council Postdoctoral Resident Research Associate (1966-1968). Visiting scientist at the High Altitude Observatory in Colorado and at the Laboratorio Plasma Spazio in Italy. Research interests include in terplanetary magnetic fields and plasmas, magnetohydrodynamics, interaction of the solar wind with planets and comets, and magnetospheric physics. Coinvestigator on several satellite experiments, including experiments on Voyager, Helios, and Explorers 34, 41 and 43. Author of more than 70 scientific articles. Recipient, NASA Exceptional Scientific Achievement Medal, 1979. Committee memberships include Solar and He liospheric Physics Management Operations Working Group; interplanetary Physics Work ing Group; Comet Science Working Groups; and Working Groups for OPEN, Plasma Turbulence Explorer, Solar Corona Explorer, and the Solar Cycle and Dynamics Mission. Member, American Physical Society; International Astrophysical Union; Chairman, Division IV of the international Association of Geomagnetism and Aeronomy.



Bruce T. Tsurutani. B.A., Ph.D., University of California at Berkeley. Has been the Jet Propulsion Laboratory, California institute of Technology, since 1972 and is presently a member of the technical staff in the Space Physics Section. Author or coauthor of 53 scientific articles. Areas of scientific interest include interplanetary physics (heliospheric magnetic field properties and configuration, cosmic ray modulation), solar wind interaction with magnetospheres (upstream waves and particles, magnetic merging, viscous interaction), plasma physics (instabilities and wave-particle interactions). particle acceleration processes (interplane tary and magnetospheric), auroral physics (particle precipitation and substoms), astrophysics (X ray bursters). He is a member of the American Geophysical Union, the American can Association for the Advancement of Sch ence, Sigma Xi, the New York Academy C Sciences, and the international Union of Rat dio Science. Currently a coinvestigator on the international-Sun-Earth-Explorer (ISEE-3) Interplanetary Magnetic Field Investigation, a collecting to the European Space Agent cy International Solar Polar Mission Magnetic Fleid investigation, and a guest investigat on the ISEE 1 and 2 plasma wave, plasma, and magnetic field experiments. Served as a member of the NASA Plasma Turbulence

Explorer Study Group and the NASA Solar Polar Mission Study Group. Coorganized an ISEE Upetream Wave and Particle Meeting and a special issue of JGR.

# **Tectonophysics: President-Elect**



AGU since 1959; age 44. He is currently professor of geophysics at the California insti-ule of Technology. His research interests include physics of the earth's interior, especially equation of state of rocks and minerals, ncluding polymorphism and dynamic yielding. Also, impact processes on planetary surfaces and theories of accretion and evolution of volatiles on the terrestrial planets. Borehole in-situ stress and tilt measurements. He received his B.S. from the Massachusetts institute of Technology, 1957; his M.S. from California Institute of Technology, 1958; and his Ph.D. from Rensselaer Polytechnic Institute, 1962. He served as a geophysicist with the Pan American Petroleum Corporation 1958-1959; a 2nd Lleutenant, U.S. Army, 1959-1960; as a geophysicist at the Stan-lord Research Institute, 1962-1967, prior to coming to the California Institute of Technology in 1967. He has served as president. (San Francisco) Bay Area Geophysical Societv. 1966–1967; associate editor. *Journal of* Geophysical Research, 1972-1974; asso-ciate editor, Review of Scientific Instruments, 1972-1974; NSF Earth Sciences Advisory Panel, 1973-1976; chairman, Geophysics Gordon Research Conference, 1974; president, Sigma Xi, Caltech chapter, 1974-1975; advisory editor, Physical Chemistry of Minerals, 1976-present; NASA Lunar and Planetary Review Panel, 1978-1980; Advisory Committee, Division of Earth Sciences NSF, 1979-present; editor, Journal of Geophysical arch (Red), 1979-1982. He has pub-Ished 113 papers, 32 in AGU journals; the most important are: Calculated mineral reactions in the earth's mantle (JGR, 1967); The basalt-eclogite reaction rate and its geophysical significance (Reviews of Geophysics and Space Physics, 1975); Impact-Induced energy partitioning, melting, and vaporization on Istrestrial planets (Proc. 8th Lunar Science Conference); Equation of state of iron sulfide and constraints on the sulfur content of the



earth (JGR, 1979).

AGU since 1958; age 56. He is currently Walter P. Murphy Professor of Materials Sci-ance and Engineering, the Department of Materials Science and Engineering, and prolessor of geophysics, Department of Geologihe has been since 1959. His areas of scientific interest include dislocation theory, creep of crystalline solids, glacier mechanics, geothermal energy, fatigue, and fracture solids. He received his B.S. (1948) and D.Sc. (1951) in physics at Carnegie Institute of Technology (now Carnegie-Mellon Universi-1. He was a Fulbright Fellow 1951-1952 at he Ecole Normale Superieure in Paris; with the Naval Research Laboratory from 1952 to ing professor in geological sciences at ech 1964; and Guggenheim Fellow at Scott Polar Research Institute of Cambridge University (1970-1971). He received the Robert E. Horton Award of the Hydrology Section of AGU in 1962 for a paper in JGR on stability of ice age sheets; the Champion 1. Mathewson Gold Medal of AIME in 1977; and Acta Metallurgica Gold Medal in 1980. In 1976 he was elected to membership in the National Academy of Engineering. He has served as an associate editor of JGR (1972-1975) and on the Committee on Glaciers (1981–1989), where he served as chairman (1966-1969). He is the author or coauthor of over 200 publications, including 20 in AGU lournals. He is coauthor coeditor of two books. He is a fellow of the American Sociely for Metals, The American Physical Sociey, and the Geological Society of America. He is a member of AIME, AAAS, the International Glaciology Society, Arctic Institute of North America, American Quaternary Associallon, ASTM, European Geophysical Society. He was chairman of the 1969 Gordon Conlerence on physical metallurgy, editorial advisor to the Journal of Glaciology (1972-present), and served on various committees of

AIME, ASM, and NAS/NAE,

**Johannes Weertman.** A member of

# Tectonophysics: Secretary



Christopher Scholz. Age 38, is professor of geological sciences at Lamont-Doherty Geological Observatory of Columbia University. A member of AGU since 1967, he received a B.S. from the University of Nevada in 1964 and a Ph.D. from MIT in 1967. He joined L-DGO following a postdoctora year at Caltech. A past member of the U.S. National Committees on seismology and on rock mechanics, he was a Stoan Fellow in 1975-1977 and a Cecil and Ida Green Scholar at IGPP, U.C. San Diego, 1980-81. Author of 62 papers, 25 in AGU journals, his principal work has been on fracture and friction of rock, the mechanism of earthquakes and faulting, and general and regional studles of tectonics. Representative recent papers on those subjects can be found in JGR (83, p. 783, 1978; 84, p. 5525, 1979; and 84, p. 6770, 1979).



Joseph B. Walsh. Joined AGU in 1975; age 50. Currently a senior research scientist in the Department of Earth and Planetary Sciences, MIT. His scientific work is primarily theoretical, involving the application of mechanics to problems in tectonophysics, such as faulting and the elastic and anelastic properties of rock. He received his B.S. degree from MIT in 1952 and his Ph.D. from MIT in 1958. After graduation he worked for consulting engineering companies for several years. He came to the Woods Hole Oceanographic Institution in 1960 and left in 1963 to join the research staff at MIT. He has written 42 scientific articles, of which 22 appeared in AGU journals. The most interesting of these are his work on the effect of cracks on the elastic properties of rock (JGR, 70(2), 381, 1965), the role of pore fluid or interstitial melt on wave velocities and attenuation (JGR, 74(17), 4333, 1969), and the changes in gravity resulting from faulting (JGR, 84(B1), 165, 1979). He served as associate editor of JGR for the period 1975-77.

#### Volcanology Geochemistry and Petrology: President-Elect



G. Brent Dairympie. Age 44; a member of AGU since 1963, fellow since 1975; currently regional geologist, Western Region, U.S. Geological Survey. Areas of current interest include history of geomagnetic field, origin of linear volcanic chains, geology of Hawalian Islands, evolution of volcanic systems, origin and evolution of seamounta, development of radiometric dating techniques. A.B., Occidental College, 1959; Ph.D., University of California, Berkeley, 1963, Employed by U.S. Geological Survey 1963-present; lecturer and research associate. Stanford University 1969-1971; visiting professor Stanford, 1972. Fellow, Geological Society of America; member, American Quaternary Association; councilor, American Quaternary Association, 1971-1972; American Com alon on Stratigraphic Nomenciature, 1973-1976. More than 80 published papers, the most important of which include a series on geomagnetic reversals, a series on the origin of the Hawalian Islands, and a book on K-Ar dating, Member, AGU Monograph Board, 1971-1973, and secretary of the VGP Section since 1980.



Heinrich D. Heiland. Age 54; a member of AGU since 1950 and a fellow since 1973. He is currently professor of geochem Istry at Harvard University and is occupied with research dealing with the chemistry and chemical evolution of the atmosphere and oceans and with the nature of hydrothermal solutions. He received his B.A. (1946) in chemistry from Princeton University, his M.S. (1948) and Ph.D. (1952) degrees in geology from Columbia University. An honorary M.A. (1972) was conferred by Harvard University when he joined the faculty there. He was a member of the faculty of Princeton University from 1950 to 1972. During this time he was also an NSF Postdoctoral Fellow at Oxford University (1956-1957), a Fulbright Fellow at Durham University and Imperial College, London (1963-1964), and a visiting professor at the University of Hawaii (1968-1969). Since joining Harvard University (1972), he has held a Guggenhelm Fellowship (1975-1976), received a Humboldt Award (1980) tenable at Heidelberg University, and was a visiting professor at the University of Hawaii (1981). He is a member of the National Academy of Sciences, the American Acade my of Arts and Sciences, the Geochemical Society, the Geological Society of America, the Society of Economic Goologists, the Mineralogical Society of America, the American Association for the Advancement of Science, and the International Association of Geochemistry and Cosmochemistry. He has held all of the major offices in the Geochemical Society. He has published two books and approximately 100 papers and is currently completing a book dealing with the chemical evolution of the atmosphere and oceans. He was chairman of the Bowlo Modal Committoo of the AGU from 1978 to 1980.

#### Volcanology, Geochemistry and Petrology: Secretary



J. Lawford Anderson. Age 33; a member of AGU since 1975. He is presently an associate professor of geology at the University of Southern California, Los Angeles. Principal research interests are in the fields of igneous petrology, petrochemistry, and mineral equilibria. A native of Goose Creek. Texas, he holds a B.A. (1970) in geology from Trinity University and a M.S. (1972) and Ph.D. (1975) in geology from the University of Wisconsin (Madison). Anderson has been teaching at USC since 1975. In addition to AGU he is a member of the Geological Soci-

ety of America, American Association for the Advancement of Science, and Sigma Xi. For the past 3 years he has served on the Abstract Review Panel for the Cordilleran Seclion of GSA. He has published over 13 papers and 19 abstracts (three in AGU publications) that deal primarily with the evolution of granitic magmas, specifically their genera-tion, crystallization, deformation, and associated tectonic setting. Recent work has centered on the mineralogy and petrology of an-orogenic granite plutonism of the late Precambrian of North America, Mesozoic-to-Tertiary two-mica granites of the southwestern U.S., and conditions of mylonitization and other forms of cataclasis in Cordilleran metamorphic complexes. The following 1980-1981 publications are representative of his present research:

Anderson, J. L., Minoral equilibria and crystallization conditions in the Late Precambrian Wolf River rapakivi massif, Wisconsin, Am. J. Sci., 280, 2389-332, 1980.

Anderson, J. L., R. L. Cullers, and W. R. Van Schmus, Anorogenic metaluminous and peraluminous granite plutonism in the Mid-Proterozoic of Wisconsin, U.S.A., Contrib. Mineral, Petrol., 74, 311–328, 1980.

Anderson, J. L., R. H. Osborne, and D. F. Palmer, Petrogenesis of cataclastic rocks within the San Andreas Fault Zone of southern California, U.S.A., *Tectonophysics*, 67, 221–249, 1980.

Anderson, J. L., and M. C. Rowley, Synkinematic instrusion of peraluminous and associated metaluminous granitoid magmas, Whipple Mountains, California, Can. Mineral., 19, 83–101, 1981

Davis, G. A., J. L. Anderson, E. G. Frost, J. J. Shackellord, Mytonitization and detachment faulting in the Whipple-Buckskin-Rawhide Mountains terrane, southeastern California and western Arizona, in Metamorphic Cure Complexes, edited by M. Crittengen, G. H. Davis, and P. J. Coney, Geol. Suc. Am. Mom., 153, 79-129, 1980.

Peter W. Lipman. Age 46, a member of AGU since 1967. He has worked for the U.S. Geological Survey in Denver, Colorado. since completing his Ph.D. at Stanford University in 1962. Lipman's primary scientific interests concern broad aspects of volcanism, including held geology, relations between volcanism and subvolcanic infrusions. geochemistry and isotopic chemistry of magmas, structural features of volcanos relations between volcanism and plate lectonics. the role of volcanism in planetary evolution. geodetic monitoring and hazards analysis of active volcanos, volcanic activity in relation to geothermal energy, and significance of volcanism to ore deposition. Lipman bus been project chiof of several of several USGS studies of Cenozoic volcanic centers in Colorado, New Mexico, Utah, and Nevada. In addition he has worked on active volcanos In Japan, Hawaii, and most recently, on the 1980 eruption of Mount St. Helens, Lipman has authored or coauthored approximately 175 scientific articles and papers. He is currently coeditor of the USGS Professional Paper on the 1980 eruptions of Mount St. Helens, Washington, and is also an editor for the Cordilleran volume of the Geological Society of America's centental publication series 'Decade of North American Geology. Lipman is a fellow of the Geological Society of America and the Mineralogical Society of America; in 1980 he was made an honorary member of the Colorado Scientific Society.

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# Meetings



# 1981 AGU Fall Meeting

The 1981 Fall Meeting will be held at the Jack Tar Hotel and the Holiday Inn/Golden Gateway in San Francisco from December 7-11.

#### Registration

Everyone who attends the meeting must register.

Preregistration (received by November 17) saves you time and money, and the fee will be refunded if AGU receives written notice of inability to attend by November 30. Registration rates are as follows:

	Preregistration	At-Meeting (after 11/17)
Member	<b>\$5</b> 5	\$70
Student Member	\$25	\$40
Nonmember	\$75	\$90
Student nonmember	\$32	\$47

Registration for 1 day only is available at one half the above rates. Members of the American Meteorological Society, the American Society of Photogrammetry, Union Geofisica Mexicana and the American Congress on Surveying and Mapping may register for the meeting at the AGU member rates.

The difference between member (or student member) registration and nonmember registration may be applied to AGU dues if a completed membership application is received at AGU by February 13, 1982. Current AGU annual membership rates are: \$20 members; \$7 student members.

To preregister, fill out the registration form, and return it with your payment to the AGU Office. Your receipt will be included with your preregistration material at the meeting. Preregistrants should pick up their registration material at the preregistration deak at the Holiday inniGolden Gateway Hotel. Complimentary badges for guests not attending the scientific sessions will be available at the registration desk.

#### Scientific Sessions

The scheduling of the scientific program will be published in EOS, October 20. Both hotels will be utilized for all

#### Hotel Accommodations

A block of rooms (\$41 singles; \$47 doubles) is being held for meeting attendees at the Jack Tar Hotel and at the Holiday inn/Golden Gateway. Reservations are processed as they are received, so if you wish to stay at a particular hotel, you should make your reservation as early as possible. Remember your fellow scientists need a room. Reserve in one hotel only. Don't be a no-show!

Reservations must be received by November 12 to be confirmed. Please use the form provided to be assured of the special AGU rate, and mall it directly to the hotel of your choice. Do not write or call the AGU office for room reserva-

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AMERICAN GEOPHYSICAL UNION

1981 FALL MEETING

REGISTRATION FORM

Golden Galeway Hotel

December 7-11, 1981

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Jack Tar Hotel/Holiday Inn-

#### Social Events

Two parties are planned for registrants. The ice Breaker will be on Monday at the Jack Tar Hotel; and a wine and cheese party on Thursday at the Holiday Inn/Golden Gateway Hotel.

Complimentary refreshments will be served daily at both hotels from 9:30 to 10:30 A.M. and 2:30 to 3:30 P.M.

# **Business Meetings and Sections**

The AGU Council will meet Sunday at 5:00 pm in the Japanese Pavillion (formerly the Garden Room) of the Jack Tar Hotel.

The Tectonophysics section business meeting will follow an afternoon technical session (TBA). The Nikko, Van Ness and Pine; the Casa de Cristal, 1122

Post Street; and the Four Seas, 731 Grant Avenue, are the restaurants that will provide an atmosphere of conviviality for the section luncheons and dinner as listed below:

#### Tuesday, December 8

Casa de Cristal Nikko

noon \$8.00 \$3.75 noon

## Wednesday, December 9

Casa de Cristal noon \$8.00 Nikko Banquet Oceanograph noon Nikko (T/K room) 11:45 a.m. Meteorology \$8.25 Solar-Planetary 6:00 p.m. Four Seas \$12.00

 Special Chinese Gourmet Banquet Business meeting at 6 p.m., followed by the banque! at 7:30. Reservations in advance required!

### Thursday, December 10

Volcanology, Nikko Banquet Geochemistry, and noon \$8.25 Petrology

 An opportunity for members of both sections to meet In an informal atmosphere to discuss subjects of mutual interest.

Geomagnetism Nikko (T/K room) 11:45 a.m. \$8.25

Advance reservations are suggested (SPR-required) and will be processed as they are received based on availability of space. Complete the registration form now.

Arrival Date\_

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# AMERICAN GEOPHYSICAL UNION FALL MEETING December 7-11, 1981

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# International Laser Radar Conference

A call for papers has been issued for the 11th international Laser Radar Conference, slated for June 21-25, 1982, at the University of Wisconsin at Madison.

The program, to consist of invited and contributed papers, will include discussions on meteorological lidar (light and detection ranging) investigations, including clouds, precipitation, water vapor, temperature, pressure, and winds; studies of the atmosphere, using lidar; Ildar investigations of tropospheric chemistry and diffusion; applications of lidar to almospheric propagation and radiative transfer; and new lider concepts and applications.

Abstract deadline is February 28. For details on the abstract format and further conference information, contact Jody Edwards, Conference Coordinator, 11th International Laser Radar Conference, Space Science and Engineering Center, 1225 West Dayton Street, Madison, WI 53706 (telephone: 608/263-6780).

The conference, to be held under the auspices of the Committee on Laser Atmospheric Studies (CLAS) of the American Meteorological Society, is sponsored by the Space Science and Engineering Center of the University of Wisconsin at Madison. The Optical Society of America and he Radiation Commission of the International Association of Meteorology and Atmospheric Physics (IAMAP) are cooperating organizations. James A. Weinman, of the Department of Meteorology and the Space Science and Engineering Center, is program chairman. 88

cosponaored by AGU.)

Boulder, CO 80307.)

Aug. 17-28 Third Scientific Assembly of IA-

MAP with Extraordinary General Assem-

bly, Hamburg, Federal Republic of Germa-

lug. 24-26 International Symposium on

ny. (S. Ruttenburg, NCAR, P.O. Box 3000,

Management of Geodetic Data, Copenha

gen, Denmark. Sponsors, IAG, the Danish

National Committee of IUGG, Geodaetisk

Data, Geodaetisk Institut, Gamlehave Alle

and Mapping, 210 Little Falls Street, Falls

Aug. 28-Sept. 9 Arc Volcanism Sympo-

slum, Tokyo, Japan. Sponsors, Volcano-

logical Society of Japan, IAVCEI. (Daisuke

Shimozuru, IAVECEI Symposium on Arc

Univ. of Tokyo, Bunkyo-ku, Tokyo 113 Ja-

Aug. 31-Sept. 2 Third International Collo-

quium on Mars, Pasadena, Calif. Spon-

atory, Pasadena, CA 91109.)

platz 8, D-8000 Munchen 22.)

sors, NASA, Lunar and Planetary Institute,

Division of Planetary Sciences of the AAS.

(Conway W. Snyder, Jet Propulsion Labo-

Aug. 31-Sept. 5 Symposium on Geodetic

West Germany. Sponsor, IAG. (Deutsche

Networks and Computations, Munich,

Geodatische Kommission, Bayerischen

Akademie der Wissenschaften, Marstall-

Sept. United Nations Symposium on Water Management in Industrialized Areas, Lis-

bon, Portugal. (Chairman of the Executive

Committee, International Symposium on

Water Management in Industrial Areas,

Portugal.)
Sept. 7–12 Third International Symposium

on Anlarctic Glaciology, Columbus, Ohio.

Sponsors, International Commission on

Snow and ice, international Glaciologica

Society. (Institute of Polar Studies, Ohio

Sepl. 8-12 American Society of Photo-

OH 43210.)

Park, CA 94025.)

State Univ., 125 S. Oval Mall, Columbus,

grammetry-American Congress on Survey-ing and Mapping Fall Convention, San

345 Middlefield Road, Mall Stop 31, Menlo

pt. 9-13 Symposium and Workshop on

Applications of Remote Sensing for Rice

institute for Atmospheric Optics and Re-

mote Sensing, National Remote Sensing Agency. (A. Deepak, Institute for Atmo-

ept. 13-17 National Water Well Associa-

Water Technology Education Session

lion 33rd Annual Convention and Ground

(ansas City, Mo. (NWWA, 500 West Wil-

son Bridge Rd., Worthington, OH 43085.)

d. 18-18. Oceans '81, Boston, Mess.

Ponsors, Marine Technology Society.

Box P. Hampton, VA 23666.)

pheric Optics and Remote Sensing, P.O.

oduction, Hyderabad, India. Šponsors,

Francisco, Calif. (L. W. Aggers, USGS,

Portuguese Water Resources Association,

ocanism, Earthquake Research Institute,

Institut. (C. C. Tscherning, International

Symposium Management of Geodetic

22, Charlottenlund DK-2920 Denmark.)

Aug. 24-29 Eighth Annual Meeting of the

556, 22 Úppsala, Sweden.)

Church, VA 22046.)

IEEE Council of Oceanic Engineering. AGU. (R. Nagle, Publicity Manager, Raytheon Company, 141 Spring St., Lexing-

**Geological Information Conference** 

trips are slated during the conference.

deadline is November 15.

SW7 5BD, United Kingdom.

The Second International Conference on Geological In-

formation will be held at the Colorado School of Mines on

May 23-27, 1982. Theme of the meeting will be interna-

tional cooperation to identify and share geological informa-

tion. Sessions will focus on current activities in national sur-

veys and geoscience information groups; international pro-

grams and their prospects for the future; and development

of inventories of natural resources information. Several field

Authors wishing to contribute a paper should send a ten-

tative title by October 1 to D. C. Ward, International Confer-

ence on Geological Information, 223 Natural History Build-

Ing, 1301 West Green St., Urbana, IL 61801. The abstract

Correspondence from North America concerning the con-

ference should be addressed to Ward. All others are urged

to write to A. P. Harvey, Department of Library Sciences.

Brillsh Musuem (Natural History), Cromwell Road, London

The conference will be sponsored and organized by the

Geoscience information Society and the Geological Infor-

ation of Chief Librarians of National Geological Surveys.

and the Association of Geoscientists for International De-

mation Group of the Geological Society of London together

with the International Union of Geological Sciences, Associ-

velopment. H. K. Phinney, Jr., library director at the Colora-

ton. MA 02173.) Sept. 17-18 Midwest Meeting, Minneapolis, Minn. (Meetings, AGU, 2000 Ftorl-da Ave., N.W., Washington, DC 20009.) Sept. 17–18 Pacific Northwest Regional Meeting, Ellensburg, Wash. (Bob Bentley, PNAGU, Central Washing-

ton University, P.O. Box 1000, Department of Geology, Ellensburg, WA 98920.) Sept. 20-22 National Water Well Association 34th Annual Convention and Exposition, Atlanta, Ga. (NWWA, 500 West Wilson Bridge Rd., Worthington, OH 43085.) Sept. 28-Oct. 10 NATO Advanced Study

Institute on Chemistry of the Unpolluted and Polluted Troposphere, Corlu, Greece (W. Jaeschke, Center of Environmental Protection, University of Frankfurt, Robert-Mayer-Str. 11, 6000 Frankfurt/Main, FRG.) Oct. 6-8 International Conference on Time Series Methods in Hydrosciences, Burlington, Ontario. Sponsors, National Water Re-

European Geophysical Society, Uppsala, Sweden. (C.-E. Lund, Chairman Local Orsearch institute of the Canada Centre for Inland Waters and Water-Resources ganizing Committee, Institute of Solid Branch of Ontario's Ministry of Environ-Earth Physics, Uppsala University, Box ment. (A. El-Shaarawi, Aquatic Physics and Systems Division, NWRI, Canada Aug. 25-27 The Royal Institution of Char-Centre for Inland Waters, P.O. Box 5050, lered Surveyora Centenary Celebration, Burlington, Ontario L7R 4A6 Canada.) London, England. (Representative Radlinski, American Congress on Surveying

Oct. 7-9 John Mulr Geophysical Society's Fourth Nonannual Meeting, Lake Arrowhead, Calif. (M. McNutt, USGS, Menlo Park, CA 94025.)

Oct. 11-14 Coastal Society's Seventh Annual Conference, Galveston, Tex. (N. West, Coastal Society Conference, Department of Geography and Marine Affairs, Univ. of Rhode Island, Kingston, RI

Oct. 11-15 51st Annual International Meeting of the Society of Exploration Geophysicists, Los Angeles, Calif. (William L. Baker, Technical Program Chairman, c/o Chevron Oil Field Research Co., Box 446, La Habra, CA 90631.)

Oct. 12-16 Third International Ocean Disposal Symposium, Woods Hole, Mass. Sponsor, Office of Marine Pollution Assessment, NOAA. (I. W. Duedall, Marine Sciences Research Center, State University of New York, Stony Brook, NY 11794.)

Oct. 13-15 Fifth Geopressured-Geotherma Energy Conference, Baton Rouge, La. Sponsors, Louisiana Geological Survey, Department of Natural Resources; Energ Programs Office, Louisiana State University; U.S. Department of Energy. (Ann Bachn, Conference Coordinator, Energy Programs Office, 105 Hill Memorial, Louisia State Univ., Baton Rouge, LA 70803.)

Oct. 13-16 Division of Planetary Sciences of the American Astronomical Society Annual Meeting, Pillsburgh, Pa. (B. Hapke, Dept. of Geology and Planetary Science. 321 Old Engineering Hall, University of Pitteburgh, Pittsburgh, PA 15260.)

Oct. 14-16 Third Surveying and Mapping Collegulum for the Petroleum Industry, Banfi, Alberta, Canada, Sponsor, Canadian Petroleum Association. (Liz Hampton, Canadian Petroleum Association, 1500, 633 Sixth Ave., S.W., Calgary, Alberta, Oanada T2P 2Y5.)

Oct. 19-22 Earth Impact Conference, Snowbird, Ulah. Sponsors, Lunar and Planetary Institute, National Academy of Sciences. (Earth impact Conference, Lunar and Planetary Institute, 3303 NASA Road 1, Houston, TX 77058.)

Oct. 22-24 Fourth Conference on the Physics of the Jovian and Saturnian Mag-netospheres, Laurel, Md. Sponsor, NASA. (S. M. Krimigis, Appiled Physics Laboralory, Johns Hopkins Univ., Laurel, MD

20810.) Symposium on Quaternary Oct. 26-30 Symposium on Quaternary Land Sea Migration Bridges and Human

do School of Mines, is the local committee chairman. \$ Occupation of Submerged Coastlines, La Jolla, Calif. Sponsors, Quaternary Shorolines Commission of the International

> ers, Scripps Institution of Oceanography, A6-012, La Jolla, CA 92093.) Oct. 28-30 26th Annual Midwest Groundwater Conference, Bismarck, N. Dak. Sponsors, North Dakota Stato Water Cornmission, North Dakota District WRD-USGS, North Dakota Geological Survey, North Dakota WARI. (D. Ripley, North Dakota State Water Commission, 900 E.

Union for Quaternary Research, Scientific

Committee of the World Confederation of

Underwater Activities. (Patricia M. Mas-

Boulevard, Bismarck, ND 58501.) Oct. 29-31 28th Annual Eastern Pacific Oceanic Conference, Idlewood, Calif. (R. Michael Laurs, EPOC Secretary, Southwest Fisheries Center, NMFS, La Jolla, CA

November 1-6 Sixth Biennial International Estuarine Research Conference, Gleneder Beach, Oreg. Sponsor, Estuarine Research Federation. (Jay F Watson, Treasurer, USFWS Suite 1962, 500 N.E. Multnomah Street, Portland, OR 92232.) Nov. 2-5 GSA Annual Meeting, Cincinnati, Ohio. (J. M. Latulippe, Meetings Department, GSA, P.O. Box 9140, Boulder, CO

Nov. 2-6 International Conference on the Venus Experiment, San Francisco Bay Area, Calif. Sponsor, NASA. (Dr. Lawrence Colin, Ames Research Center, Moffett

Fteld, CA 94035.) Nov. 9-11 Special Conference on the Mechanical Behavior of Salt, University Park, Pa. Sponsor, Rock Mechanics Laboratory, Department of Mineral Engineering, Pennsylvania State University. (H. Reginald Hardy, Jr., Rock Mechanics Laboratory. Room 117, Mineral Sciences Building.

Pennsylvania State University, University Park. PA 16802.) Nov. 9-11 Workshop on Comparisons Between Lunar Breccias and Soils and Their Meleoritic Analogs, Houston, Tex. Sponsor, Lunar and Planetary Institute. (P Jones, Projects Manager, Lunar and Plan-etary Institute, 3303 NASA Road 1, Hous-

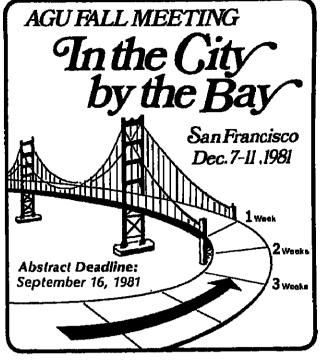
ton, TX 77058.). Nov. 9-20 Second Symposium on Geodesy in Africa, Nairobi, Kenya. Sponsors, IAG. IUGG Local Committee of Kerrya, IUGG Committee on Advice to Developing Countries, African Association of Cartogra phy. (R. Omandi, Survey of Kenya, P.O. Box 30046, Nairobl, Kenya.) Nov. 30-Dec. 11 43rd Session of the inter-

national Statistical Institute, Buenos Aires, Division, Box 218, Yorktown Heights, NY 10598; or G. S. Walson, Bernouili Society for Mathematical Statistics and Probability. Department of Statistics, Princeton Univ., Princeton, NJ 08544.)

Dec. 3-5 Topical Conference on the Processes of Planetary Rifting, San Francisco, Calif. Sponsor, Lunar and Planetary Institute. (Rift Meeting, Projects Office, Lunar and Planetary Institute, 3303 NASA Road 1, Houston, TX 77058.)

Dec. 7-11 AGU Fall Meeting, San Francisco, Calif. (Meetings, AGU, 2000 Florida Ave., N.W., Washington, DC 20009.)
Dec. 18-19 Annual International Meeting of the Working Group on Mediterranean Ophiolites, Florence, Italy. (Luigi Becca-luva, Istituto di Petrografia, Via Gramsci S, 43100 Parma, Italy.)

Jan. 11-14 Symposium on the Understanding of Hydrologic Processee at the Basin Scale, Caracas, Venezuela. Sponsore. Universidad Simón Bolivar, IAHS, (Ignacio Rodríguez-Iturbe, Universidad Simón Bolf-



var, Apartado Postal 80.659, Caracas 1081, Venezuela.)

Jan. 13-15 National Radio Science Meeting, Boulder, Colo. Sponsors, U.S. National Committee for the International Union of Radio Science, IEEE. (U.S. National Committee for URSI, National Research Council, 2101 Constitution Avenue, N.W., Washington, DC 20418.)

Jan 24-29 Conference on Origins of Plasmas and Electric Fields in the Magnetosphere, Yosemite National Park, Calif. Sponsors, NASA, AGU. (F. T Berkey, Contor for Almospheric and Space Sciences, Utah State University, UMC 34, Logan, UT 84322.)

Feb. 8-12 Third International Geodetic Symposium on Satellite Doppler Positioning, Las Cruces, N Mex. Sponsors, Defense Mapping Agency. National Ocean Survey, AGU. (Richard Peat, Defense Mapping Agency, Hydro-graphic Topographic Center, 6500 Brooks Lane, N.W., Washington, DC 20315.) Feb. 16-19 Ocean Sciences: AQU/

**ASLO (American Society of Limnol**ogy and Oceanography) Joint Meeting, San Antonio, Tex (Meetings. AGU, 2000 Florida Ave., N.W., Washington, DC 20009.)

Feb. 25-26 13th Annual Meeting of the International Erosion Control Association. Salt Lake City, Utah. (M. McMillan, Erosion Control Consultants, P.O. Box 195, Pinole, CA 94564.)

Mar. 22-26 International Symposium on Hydrothermal Reactions, Yokohama, Ja-pan. Sponsor, Tokyo Institute of Technolo-gy. (Shigeyuki Somiya, Research Labora-tory of Engineering Materials, Tokyo Institute of Technology, Nagatsuta, Midori, Yokohama, 227 Japan.)

Mar. 24-27 Conference on Earthquake Hazards in the Eastern San Francisco Bay Area, Hayward, Calif. Sponsors, USGS. East Bay Council on Surveying and Mapping, Calif. Div. of Mines and Geol., Woodward-Clyde Consultants, Calif. St. Univ. at Hayward. (Sue Hirschfield, Dept. of Geological Sciences, California State University, Hayward, CA 94542.)

Apr. 11-16 Penrose Conference on Antarctica, Shenandoah National Park, Va. Sponsor, GSA. (lan W. D. Daizell, Lamont-Doherty Geological Observatory, Columbia University, Pellsades, NY 10964.) April 19–21 Cordilleran Section, Geological

Society of America and Seismological Society of America Annual Meeting, Ana-heim, Calif. (Neil Maloney, Earth Science Department, California State Univ., Fuller-

April 27-29 Chapman Conference on **Rainfali Rates,** Urbana, III. (Meetings, AGU, 2000 Florida Avenue, N.W., Washinglon, DC 20009.) May 3-6 Chapman Conference on the Discentinuities in Rock: Their

Role and Significance in Geologic Processes, Sante Fe, N. Mex. (Meetings, AGU, 2000 Florida Avenue, N.W., Washington, DC 20009.) May 3-7 14th International Liège

Collegulum on Coean Hydrodynamtes, Liège, Beigium. Sponsors IAPSO, Unesco Marine Sciences Division, EGS. Intergovernmental Oceanographic, AGU. (Jacques C. J. Nihoul, University of Liège, Mecánique des Fluides Géophysi Environment, B8- Sart Tilman, B-4000

Liège, Belgium.) May 7-20 General Meeting of IAG, Tokyo, Japan. (I. Nakagawa, Geophysical Institule, Kyoto University, Sakyo-ku, Kyoto 606 Japan.)

May 10-12 Fourth International Conference on Planning and Management of Water Urban Use, Marsellies, France. Sponsore,

de Planification des Eaux (C.E.M.P.E.). Société des Eaux de Marseille (S.E.M.). the Bureau de Recherches Goologiques et Minières (B.R.G.M.), Centre de Formation Internationale à la Gestion des Rossources en Eau (CEFIGRE), UNESCO, Commission des Communautés Européennes. Association des Hydrogéologues (AIH). (Socretariat de la Conference, Sociote des Eaux de Marsellle, 25 rue Edouard Delanglado—13006 Marsolle. France.)

May 17-22 International Solar-Terrestrial Physics Symposium, Ottawa, Ontario. Canada (Professor Llu, University of Illinois, Urbana, IL 61801.)

May 17-June 3 24th Plenary Meeting of COSPAR, Ottawa, Ontario, Canada (T. W. McGrath, Executive Member, Local Organizing Committee, XXIV COSPAR, Conference Secretarial, National Research Council, Ottawa, Ontorio K1A OR6, Cana-

May 23-26 Eastern Conference on Water

and Energy: Technical and Policy Issues. Pittsburgh, Pa. Sponsors, ASCE, League of Women Votors, Council of State Governments. (F. Kilpatrick, USGS National Center, Mail Stop 414, Roston, VA 22092.) May 23-27 Second International Conference on Geological Information, Golden, Colo. Sponsors, Geoscience Informatio Society, Geological Information Group of the Geological Society of London, Internakonal Union of Geological Sciences, Assoclation of Chief Librarians of National Geological Surveys, Association of Geoscienlists for International Development, (D.C. Ward, International Conference on Geo-

IL 61801 May 24-28 Joint International IEEE/APS Symposium, National Radio Scienco Meeting, and Nuclear Electromagnetic Pulse Meeting, Albuquerque, N. Mex. Sponsors. IEEE Antennas and Propagation Society. USNC:URSI Commissions, Permanent NEM Committee. (K. F. Casey, The Dikewood Corp . 1613 University Boulevard, N.E., Albuquorque, NM 87102.)

logical Information, 223 Natural History

Building, 1301 Wost Green Street, Urbana,

May 25-28 Symposium on the Composition of Nonurban Troposphere, Wilhamsburg, VA. Sponsors, AMS, NASA. AGU (Jack Fishman, Mail Stop 401-B, NASA Langley Research Center, Hampton. VA 23665.)

May 31-June 4 AGU Spring Meeting. Philadelphia, Pa. (Meetings, AGU, 2000 Florida Ave , N.W., Washington, DC

June 13-17 International Symposium on Hydrometeorology, Denver, Colo. Sponsor. American Water Resources Association. (A. I. Johnson, Woodward-Clyde Consullants, 2909 West 7th Ave., Denver, CO 80204 )

June 15-18 International Conference on Rainwater Cistern Systems, Horiolulu, Hawaii. Sponsors, University of Hawaii's Water Resources Research Center, AGU. (Yu-Sı Fok, General Conference Chairman, Water Resources Research Center, Univ. of Hawaii, 2540 Dole Street. Honolu!u, HI 96822.)

June 21-25 11th International Laser Radar Conference, Madison, Wis. Sponsor, Space Science and Engineering Center of the University of Wisconsin. (J. Edwards,

Conference Coordinator, 11th International Laser Radar Conference, Space Science and Engineering Center, 1225 West Day-ton Street, Madison, WI 53706.)

June 27-30 Western Conference on Water and Energy: Technical and Policy Issues. Fort Collins, Colo. Sponsors, ASCE. League of Woman Voters, Council of State Governments, (D. Malchell, Stone and Webster Engineering Corp., P.O. Box 5406, Donver, CO 80217.)

June 27-July 2 Fifth International Confer ence on Geochronology, Cosmochronology, and Isotope Geology, Nikko National Park, Japan. (K. Shibata, Geological Survey of Japan, Higashi 1-1-3, Yatabe, Ibaraki 305 Japan.)

July 19-30 Scientific Meeting of IAHS with Extraordinary General Assembly, Exeter. United Kingdom, (John C. Rodda, Departmont of the Environment, Water Data Unit Reading Bridge House, Reading RG1 8PS United Kingdom.)

Aug. 2-13 Joint Oceanographic Assembly, Halifax, Nova Scotla, Canada. Sponsor, Scientific Committee on Oceanic Research. (Leo O'Quinn, National Steering Committee for JOA, c/o Canadian Cor tee on Oceanography, 240 Sparks St., Ottawa, Ontario K1A 0E6 Canada.)

Aug. 2-6 Second International Symposium Workshop on Solar-Terrestrial Influences on Weather and Climate, Boulder, Colo. Sponsor, Lockhead Palo Afto Research Laboratory. (Billy M. McCormac, Lockheed Palo Alto Research Laboratory, Dept. 52-13 B202, 3251 Hanover Street, Palo Alto. CA 94304.)

Aug. 15-21 Fourth International Symposium on Antarctic Earth Sciences, Ingle Farm, South Australia, Australia. Sponsors. Australian Academy of Science, Australian Academy of Technological Sciences, International Union of Geological Sciences, Scientific Committee on Antarctic Research, Geological Society of Australia, Inc., Univ. of Adelaide. (J. B. Jago, South Australian Institute of Technology. P.O. Box 1, Ingle Farm, South Australia, Australia 5098.)

Aug. 15-22 International Meeting on Generation of Major Basalt Types, Revkjavik. Iceland. Sponsors, IAVCEI, IAGC. (Basalt Meeting, c'o G. E. Sigvaldason, Nordic Volcanological Institute, 101 Reykjavík, Iceland.1

Aug. 15-22 IAVCEI and IAGC Joint Meet ing, Reykjavik, Iceland. (G. E. Sigvaldason, Nordic Volcanological Institute, Univ. of Iceland, Geosciences Building, 101 Revkiavik, Iceland.)

Aug. 16-18 International Conference on Coal-Fired Power Plants and the Aquatic Environment, Copenhagen, Denmark. Sponsors, International Association on Water Pollution Research, the International Union of Pure and Applied Chemistry, Nordic Cooperative Organization for Applied Research. (Dis Congress Service, Linde

Alle 48, DK-2720 Copenhagen, Denmark.) Aug. 22-28 11th International Congress on Sedimentology, Hamilton, Ontario, Canada. Sponsor, IAS. (IAS Congress 1982, Department of Geology, McMasler University, Hamilton, Ontario L8S 4M1, Canada.)

Aug. 22-28 Third Circum-Pacific Energy and Mineral Resources Conference, Honolulu, Hawaii. Sponsor, IUGS. (AAPG Convention Department

P.O. Box 979, Tulsa, OK 74101.)

Aug. 23-27 Second Symposium on Applied Glaciology, Hanover, N.H. Sponsor, International Glaciology Society. (Secretary General, International Glaciological Society, Lensfield Road, Cambridge CB2 1ER, United Kingdom.)

Aug. 24-27 Ninth Annual Meeting of the European Geophysical Society, Leeds, United Kingdom. (J. C. Briden, Department of Earth Sciences, University of Leeds, Leeds LS2 9JT, England.) Aug. 25-27 23rd U.S. Symposium on Rock

Mechanics, Berkeley, Calli. Sponsors, U.S. National Committee for Rock Mechanics, International Society for Rock Mechanics, University of California. (Organizing Committee. 23rd Rock Mechanics Symposium, c/o Richard E. Goodman. Department of Civil Engineering, 440 Davis Hall, University of California, Berkeley, CA 94720.)

Sept. 3-11 Fourth World Congress on Waler Resources, Buenos Aires, Argentina, Sponsor, International Water Resources Association. (G. E. Stout, President of the U.S. Geographical Committee, Water Resources Center, University of Illinois, 2535 Hydrosystems Laboratory, 208 N. Romine, Urbana, IL 61801.)

Sept. Third International Kimberlite Conference, Clermont-Ferrand, France. (Francolse Boudier, Université de Nantes, Laboratoire de Tectonophysique, 2 Rue de la Houssiniere, 44072 Nantes, France.)

May or Sept. Scientific Meeting of IAPSO. Halifax, Canada. (E. C. LaFond, LaFond Oceanic Consultants, P.O. Box 7325, San Diego, CA 92017.)

Oct. 4-9 International Symposium on Polders of the World, Agora, Lelystad, The Netherlands, Sponsors, Department of Civil Engineering of the Delft University of Technology, Commission on Hydrological Research of the Netherlands Organization of Applied Scientific Research, the IJsselmeerpolders Development Authority, Society for Waterworks and Land Use Planning. (I. H. Wijkel, Information Centre 'New Land, Oostvaardersdijk 01-13, 8242 PA Lelystad, the Netherlands.)

Oct. 18-21 GSA Annual Meeting, New Orleans, La. (J. M. Latulippe, Meetings Department, GSA, P.O. Box 9140, Boulder. CO 80301.)

Dec. 6-10 AQU Fall Meeting, San Francisco. Calif. (Meetings, AGU, 2000 Florida Ave., N.W., Washington, DC 20009.)

1983

Feb. 1-11 15th Padfic Science Congress, Dunadin, New Zealand. Sponsor, University of Otago. (Secretary-General, P.O. Box 6063, Dunedin, New Zealand.)

June 13-15 International Symposium on Gas Transfer at Water Surfaces, Ithaca, N.Y. Sponsors, Cornell University AGU. (W. H. Brutsaert, School of Civil and Environmental Engineering, Cornell University, Hollister Hall, Ithaca, NY 14853.)

July 18-23 Fourth International Conference on Permafrost, Fairbanks, Alaska. Sponsors, National Academy of Sciences, State of Alaska. (L. De Goes, Polar Research Board, National Academy of Sciences, 2101 Constitution Ave., N.W., Washington, DC 20418.)

Aug. 15-26 18th General Assembly of IUGG, Hamburg, Federal Republic of Germany. (P. Melchior, Observatoire Royal de Selgique, Avenue Circulaire 3, B-1180 Bruxelles, Belgium.)

Aug. 27 Symposium Commemorating the 100th Anniversary of the Mount Krakatau Eruption, Jakarta, Indonesia. Sponsor, Indonesian institute of Sciences. (Didin Sastrapradia, Deputy Chairman for Natural Sciences, L1P1 JL, Teuku Chik Ditiro 43.

Sept. 12-14 National Water Well Association 35th Annual Convention and Exposition, St. Louis, Mo. (NWWA, 500 West Wilson Bridge Rd., Worthington, OH 43085.) Oct. 31-Nov. 3 GSA Annual Meeting, Indianapolis, Ind. (J. M. Latulippe, Meetings Department, GSA, P.O. Box 9140, Boulder.

CO 80301.) Dec. 5-9 AQU Fall Meeting, San Francisco, Calif. (Meetings, AGU, 2000 Florida Ave., N.W., Washington, DC 20009.)

July 21–28 Eighth World Conference on Earthquake Engineering, San Francisco, Calif. Sponsor, Earthquake Engineering Research Institute. (R. B. Matthlese Chair-8WCEE, EERI, 2620 Telegraph Avenue, Berkeley, CA 94704.)

**FUTURE AGU MEETINGS** 

Fall Meetings December 7-11, 1981, San Francisco December 6-10, 1982, San Francisco December 5-9, 1983, San Francisco

Spring Meetings May 31-June 4, 1982, Philadelphia

AAPG American Association of Petroleum Geologista

AMS American Meteorological Society ASCE American Society of Chemical Engi-

**GSA Geological Society of America** IAG international Association of Geodesy IAGA International Association of Geomagnetism and Aeronomy

IAHS International Association for Hydrological Sciences IAMAP International Association of Meteorol-

ogy and Atmospheric Physics IAPSO International Association of Physical Sciences of the Ocean

IASPEI International Association of Seismology and Physics of the Earth's Interior IAVCEI International Association of Voicanology and Chemistry of the Earth's Interior IUGS International Union of Geological Sci-

IWRA International Water Resources Associ-MSA Mineralogical Society of America SEG Society of Exploration Geophysicists

SEPM Society of Economic Paleontologists URSI International Union of Radio Science

# GAP

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# Hydrology

A SINFLE METHOD FOR ESTIMATENC CONTECTIVE RAIN

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A SINTLE MINIOD FOR ESTIMATING CONNECTIVE RAIN

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A. A. Tenesus (Institute of Atmospheric Sciences,
Seruit Debots School of Mines and Technology,
Sepid City, South Tahots S7701), P. I. Zeith,

A. S. Tennis, and S. Sergapta

Freviets muthors have reported significant
convenities attents on stores and the volume of
rain they produce. This paper exploys that idea
to devaled a simplified method for estimating
convective schemes or stores and the volume of
rain they produce. This paper exploys that idea
to devaled a simplified method for estimating
convective schemes or stores and the volume of
rain they produce. This paper exploys that idea
to devaled a simplified as the precipitation.
The present analysat is based on rain gags and
rader data from an area in restorm Korth Pakola.
A synoptic adjustment is applied to the radar
rain volume extinate. A quantity called the
integrated Painfall Coverage can be calculated
from solver gage or main that and is found to
be wall correlated with the rain volume. The
resistant acho area shring thy one scan in one hour
neers to be the bourly radar resourcement test
correlated with the rain volume. This limited
actual, suggests that of related using toder
resistativity data and may have operational value
in some special situations. (Pakor, precipitarice, covertion).

Kater Favore, force, Farter Indige.

Rates 5, time, Cot. Parce Inting

INDERSIES OF BINKING SOM

A A Schmidt titson Forest Service, Rocky
Manutage Forest and Range Experiment Station, 240

Flavspect, Fort Collins, Colurada 48536)
Sire and shape of undblown snow particles determine and only mass lianguarded by turbulent fluxes, but also the rate of phase charge from ice to water support this course in this well-phase flow. These proposities and particle densities distate particle fail velacity, and therefore, the working strongly influence the gradients and fluxes of, tensible heel and water vapor within the transport layer.

[Initial remember of the strongery influence the gradients and the transport layer. fluxes of denuible heat and mater vapor within the transport layer.

Initial movement at the imos surface dependament on availability and impact forces of locument the transport drag. Colesion between advider particles and partial is restitution observes advides particles and partial is restitution observed, are important properties; that determine the half dead appears for anow transport.

Threshold speeds for blowing snow vary over such a large range in nature, that formulations predicting transport rate as a function of bindspeed should include threshold speed as a parameter. The expression derived by jurgen et al. [1975] is tompared with low-level show transport in the atmospheric boundary layer.

Self-similarity of wind profiles in blowing snow is a property of the flow that has been exploited for scale modeling of snow deposition around obstacles, both outdoors and in wind tunnels. Good quantitative results are obtained by careful attention to similitude requirements. Blowing snow, anoudrift, turbulent boundary layer).

Roy, Georhys. Spaco Phys., Paper IRI191

A SIGULATION OF THE EDICORDIT OF ADDSFHIBIC FOLLUTARTS IN ERGO COPER RUBGIFF 5. C. Colect (U.S. Army Cold Regions Bassacch and finginessing Laboratory, Escover, RE 09755)
The soluble importates sontiated in a snow cover can be rescentered as much as five fold in the first fractions of snowask trueff. In addition, daily toputity tuges are possible. Hell-frees the less concentrated as much as five fold in the first fractions of snowask trueff. In addition, daily toputity tuges are possible. Hell-frees the less concentrates the impurite in the lower persons of standard resource for april fractions. The preparate is impurities for april fractions. The engineers of snowphet follows the course from the snow, capectally in areas of "end practical reaction." The engineers of the soluble impurities for the snow, capectally in areas of "end practical reaction." The engineers of the soluble impurities for the snow and the results of laboratory sparishes are given. (Some cover, and therefore, attemphatic pollutants).

J199 General or Miscollaneous DATA REQUIREMENTS FOR KRIGING: ESTIMATION AND NATIONAL DESIGN

基础等於關係的基礎的關係的

MATORIE DEPICEN

J.P. Hughes and D.P. Lattenmaier (Department vid Civil Engineering Fr-10, Deliversity of Machington, Hantle, Wa 20195)

Krining, a technique for interpolating non-niationary speak lal phonomena, has recently been factorized to the diverse hydrologic problems as forespeciation of Alastonetric hands and transmissivities estimated from hydrogeologic durveys and estimation of mean areal precipitation recumulations. An apportant concern for means of this technique is the effect of samels as the on the oregiston of obstained. Comparisons made between conventional leaser squares and kriging parisonom indicate that for aamples of aim least for the forest probability of the control of the precipitation of the state of the forest parisons made between conventional leaser squares and kriging parisonom indicate that for aamples of aim least department of the forest parisons in a Bayesian seems electough kriging department. A

network design algorithm was also developed; reats performed using the algorithm indicated that the information content of identified networks was relatively insensitive to the size of the pilot notwork. These results suggest the within the range of sample sizes typically of budrolucic interest, kriging may held more notential for network design than for data analysis, fixinging, network design, spatial cellinations. utination). Aater Resour, Res., Paper 181198

# Meteorology

I'N: Boundar, Layer structures and processes
TURBULENT TRANSPORT OF ELECTRIC CHARGE IN
THE WARTNE ATMOSPHERIC BOUNDARY LAYER
Ralph Markson (Airtorne Research Associates,
46 Fendal Common Road, Weston, MA 02193)
Jan Sellaček and Christopher W. Fairall
Sensible heat, weter uppor, serosols, gescos
rollutants and electric charge are transported
vertically in the marine boundary-layer by turbulent processes. The standard eddy correlation
method of measuring fluxes from attractic regular
anertial navigation systems, considerable commethod of measuring fluxes from aircraft require inertial navigation systems, considerable computer power and large aircraft with quelt probes on specially engineered booms to correct for aircraft motions. Only a few laboratories can afford to operate aircraft systems of the required complexity. The development of a method for obtaining routine, high quality, relatively important weaksurements of at least one boundary place flux profile from light aircraft typeofficially not requiring an inertial platform or ically not requiring an inertial platform or angular motion data; could pecut enhancement of noundary-layer research on a new statistical scale. The flux of electric charge (called the scale. The flux of electric charge italied the state current; can be inferred from simple de measurements of electric field intensity and conductivity from a light afforant. Recent air craft measurements off the California coast and yood correlation of surface layer addy duried yook values with the surface unter vapor flux and the potwactive mixed layer redocity. When the feetiles itechnique also appears to have exceptional sensitivity exceed or that of the efficient surface is supposited that the with current could be used to infer the flux profiles of other passive scalars. Profiles of other passive scalars, decay in ties. Recause make charge underloss a decay in ties. He wase charge dentey does not tend to be well-mixed (pongrain) bith altitude in the planetary

學是國際產業學行動的學科學程度學

Order—layer. The ease of measuring space care density gradient allows accurate determination of the passive scalar edd diffusion coefficient, K. a paraceter that has been difficult account in the best. Thus, atmospheric electrical consumerators from adjusted have the potential for providing important new information for collection modeling and studies of boundary-layer collections. "electrology Res., Green, Paper 101096

133 Electrical phenomena (IGENTRO AMPLITUDE SPECTRA IN THE INTERVAL PRON IGENTRO AMPLITUDE SPECTRA IN THE INTERVAL PRON ION MAY TO 70 ME.

C. D. Weidman, E. P. Krider (Institute of Atmospheric Physics, University of Arisona, Tucson, Arisona 53721, U.S.A.), and M. A. Usan Interval and the sectric radiation fields produced by Hightings return strokes, scapped leaders, and interchood discharge processes bave been Pourier-analyzed to determine septitude spectra for these processes from about 100 kHz to 20 MHz. The Fields were recorded under conditions where the Highting sources to the recording site was entirally over salt water. The spectra for return strokes show an T-1 frequency dependence from 100 kHz to 20 kHz, and 1-2 dependence between 2 and 10 kHz, and an T-5 deriesse above 10 kHz. In the 1 to 20 kHz rangs, the spectra of the lattical fast transition in sturn strokes, the initial fast transition in four strokes, the initial fast transition in positive intracious pulses are aurprisingly similar. (Lightoing, thunderstorms, electromagnetic interference).

Geoglys. Res. Latt., Paper IL1077 Res, Latt., Paper 1L1077

1930 H<sub>2</sub>O in the atmosphere (humidity, clouds, and procipitation)
CAROW DIOXIDE AND CLIMATE: THE EFFECTS OF WATER
TRASPORT IN RADIATIVE-CONVECTIVE MODELS
J. F. Hassel (General Motors Research Laboratorics, Physics Department, Warren, Michigan
4870-9055) R. A. Rack
Considerable attention is being focused on tha

tories, Physica Bepartment, nature, Nature 18709-0955; R. A. Rack Caulderable attention is being focused on the possible clientic affects resulting from increase in the concentration of amospheric carbon dioxido. In catculating CO, influence on the thermal scrutture of the atmospheric, the role of clouds is critically important. Not only are the cloud properties, such as emount, numbers of thouse, slitudes, and optical properties importent but also whether or not these properties are fixed or coupled to model temperatures. The transport of water vapor determines whether or out a region has clouds, the cloud properties, with the water wapor profiles appropriate for tier and cloudy when.

Esuits are presented of the change in surface.

ilts are presented of the change in surface ature with changes in carbon dioxide contemperature with changes in carbon dioxide con-tent for two radiative-convective models with three different cloud coverages. We used (1) the Mosbe-Wathereld radiative-convective model in which three clouds with fixed pressures, thich which three clouds with raway promoters, messas, and aptical properties and a single water sapor profile are inputed and (2) the Bussust-thm model which couples radiative heating, con-version, and water waper transport in order to calculate locations and thicknesses, and a

profile.
The Russel-Kuhn model yields surface tempera-ter increases for doubled CO, larger than the Nambe-Wetherald model for various assumed total Naube-Wetherald model for various assumed total cloud cover amounts. For assumed standard cloud cover amounts the Hummel-Kuhn estimate is 20% larger than the Hanebe-Wetherald serioust. For reduced and enhanced cloud cover amounts the Exmel-Fuhn estimates are 17% and 17% larger, respectively. The calculated cloud locations and thicknesses did not change in the calculations, therefore the increased eenstivity in the Amonel-Yuhn model is due to the larger water typer amounts in the Hummel-Kuhn model and the Abded infeared absorption by the water vapor liner. Meer. J Geophys. Pes., Green, Papar 101257

JVTO Particles and Aerosols EXTERINATION OF VERTICAL PROFILES OF AEROSOL NIE SPECIES FROM AIGRAFT RADIATIVE PLUX MANUFEMENTS PART II. THE EFFECT OF PARTICLE

EXEMPLETY

8. Welch, (Institut fur Meteorologic. Johannes
Outsberg University, Mains, Germany), S. Cox
(Department of Atmospheric Salance, Colorado
Stats University) and K. Ya. Kondratyev (Main
Geophysical Observatory, Laringrad, U.S.S.R.)
The effect of particle nonsphericity upon
Us retrieval of particle size distributions.
copured from sirrerst radiative flux measurements.
has been examined for the data of 4 September 1974.
The particle inversion procedure is identical to
that described by Kondratyev et al. (1981), invalving quadramodal particle size apectra. Nonspecial particle sitemation coefficients and
phres functions were calculated nocording to the
tixi--pirical approach developed by Foliash and
Cuzil.

It was found that variations of the phase func-tion by nonephyrical particles affocted the re-retral of particle size spectra to a far greator stres than did variations of particle scattering officiency. Monopherical particles generally have Signs than did variations of particle scattering efficiency. Noncherical periods genticles generally have mailer values of saymetry factor than do their professional particles show decreused values that of large and small particle number denotices sing sits breakening of the large particle with to include particles of larger 2002.

J70 Particles and Aerosolc ETERMINATION OF VERTICAL FROFILES OF AER'SOL SIZE SPECTRA FROM AIRCRAFT RADIATIVE FUX WARRINGHTS PART II. THE EFFECT OF PARTICLE WARRINGHTS PART II. THE EFFECT OF PARTICLE

MESPHERICITE

8. Welch, (Institut fur Meteorologie, Johannes
Gutenberg University, Mains, Germany), S. Cox
[Separtment of Atmospheric Science, Colorado
State University) and K. Ys. Kondratyev (Main
Gacphysical Chesrvatory, Lerdagrad, U.S.S.R.)
The effect of particle monephericity upon
the retrieval of particle size distributions,
computed from aircraft radiative flux measurem
has been semanach on the data of A September. mined for the data of 4 Se The particle inversion procedure is identical to that described by Kondratyev et al. (1921), identifying quadramodel particle size spectra. Non-spherical particle strengation coefficients and phase functions were calculated according to the best-septrical approach developed by Police's and Cutst

Cuss. The suppressed overlapped by Follow and it was found that variations of the phase function by monapherical particles affected the retrivial of particle size spectra to a far greater degree than did variations of particle scattering efficiency. Nonepherical particles generally have smaller values of asymmetry factor than do their pherical counterparts. The inferred size spectra of nonepherical particles show decreased values both of large and small particle number despities along with a broadening of the large particle acts to include particles of larger sizes.

J. Goophya, Res., Green, Papar 101154

J770 Particles and Seronoln RETEMENTION OF VERTICAL PROFILES OF AEROSUL-SIZE SPECTRA PROM AIRCRAFT RADIATIVE FLOX MEA-SURDENTS, PART I. RETRIEVAL OF SPHERICAL PARTICLE SIZE DISTRIBUTIONS PARTICLE SIZE DISTRIBUTIONS

1. Ya. Kondreyaw, M. Prokolysw, V. Lyandv,

7. Earlayse (Main Geophysica) Observatory,
Laningrad, U.S.S.R.), S. Cox (Department
of Atsospheric Science, Colorado State
Matwralty), R. Welch (Institut fur Mylearologia,
Johannes Ostenberg University, Mains. Gormany,

O. Yasilyev, V. Radionov and L. Ivlev (Department
of Physics, Jeningrad State University, Leningrad,

U.S.S., 1) buring the GATE observational program, alteraliradialive flux measurements were taken at several attitudes in the Saharan dust. On the hands of these flux quastrements at 25 wavelengths in the flux on the saharan dust, the corresponding various particle size spents juyes been inferred. These particle size distributions, caloulated using apherical Me theory, have teen represented by quadramodal combinations of garm functions. The calculated quadramodal size distributions were characterized by mode radii at 0.1, 0.2, 1.0 and 2.0 pm. with a relatively

one, U.C. 1.0 and 2.0 bm, with a relatively marrow spread of particle sizes wentered shout each mode radius.

The number density of the realized particle mode said found to increase with increasing height, while that of the increasing height, while that of the increasing height, dequalized of deduced particle sizes of a "dundy" do. (A September) and u "clear" day (1) August) showed that the dusty day was characterized far more by the presence of large particles than by an inorease in rmall particle endeedination. Heating rains as large as 0.4°C/hour-up were found for 4 September 1974. J. Geophys. Res., Green, Paper 1C1153

# Mineralogy, Petrology, and Crystal Chemistry

4240 Isotope mineralogy ROSS TALE ISOTOPIC FRACTIONATION EFFECTS DI NATERIAL SPUTTERED FROM MINERALS P. K. HEFE (W. R. Kellogg Radiation laboratory, Caltach, Pasadama, GA 91125) C. C. Marson and

Ve discuss in detail a model which wakes dofinite predictions for the fractionation of isotopes In apottered material. The fractionation patterns own be non-linear, and the pattern for a partic lar sot of isotopes depends on the chemical motri within which those isotopes are contained. Calcu lations are presented for all non-concisotopic elements costained in the minerals perovskite, anorthic, advantaged in the annership paravatic, anorthic, advantaged the annership and troilite. All isotops are fractionated at the level of approximately 4-6 "you per storic mass unit. O is always positively fractionated (heavier isotopsa sputtored preferentially), and heavier claments are generally engerven; reactionized (ignore) featopes sputtered preferentially). The value of  $\delta(^{1.0}_{0.1}^{1.0}_{0.1})$  is slywys less by about 1.0  $^{0}$ /ou then a linear extrapolation based upon the scientiated b( $^{1.7}_{0.1}^{1.10}_{0.1}$ ) value would suggest. The phenomenon oboth negative and positive fractionaries patterns from a single largest mineral can be used to make an experimental test of the proposed model. J.Geophys. Res., Rod., 180962

4260 Peragensia, petrography, and petrogensis KINON- AND TRACE-ELDMENT GEOCHEMISTRY OF VOLCAMIC ROCKS DENGED FROM THE GALPACOS SPREADING CONTER-ROLE OF CRISTAL FRACTIONATION AND MANYLE

MILE OF CHESTAR PROFITCH ON THE STATE OF THE

HUCKERSAYS CORPORED OF TRUCKOMAL CRYSCALLAND AND ACCESSED OF TRUCKOMAL CAPEGOR OF THE ACCESSED OF THE ACCESSED

had an Mg number (Mgs = Mg/Mgyrm<sup>2</sup>)) of about 65. Although the samples from 95% cannot all be da-rived from a common parantal magna, the interred parental magnam may have been darived by varying dayrees of partial mathing of a common source. The fractionation sequence consists of two parts: an intital from antichment transfellowed by a silva enrichment transfellowed into mich lawar seprement about 3% residual liquid derivad by drystal fractionation of plaquodles, cinco-pyrozens, and lesser cliving from a parental magna with an Mg number of about 65. The silica-enrichment transfer enuits from crystallisation of titanomagnetite and some apatita. Fractionation of pigeomite, which is a minor phase in the major climpyrozense fractionation using trace elements. J. Geophys. Res., 344, Paper 181150 J. Goonbys. Ros., Red, Paper 181150

# Particles and Fields-Interplanetary Space

STEEPENING, SULITON AND LANDAU DAMPING OF LARGEAMPLITUDE MACKETOSONIC WAVES \_\_\_\_ FARTICLE CODE
COMPUTER SINCLATION \_\_\_

When the summer of t magnetosonic wave is: It first exhibits steepedmagnetosonic wave is: It first exhibits steepeding because of nonlinear propagation charactering because of nonlinear propagation charactering because of nonlinear propagation characterincluded time of social content of the magnetic field profile. Comparison with an existing nonlinear binnic theory for the nonlinear propagation velocity and the ateapening, line shows a good
agreement between the theory and the signistion
up to a time of shock formation, The measured
Landau damping rate in the simulation agrees well
landau damping rate in the simulation agrees well
with the linear binetic theory even for largemapifieds magnetosonic waves. This is the casewhen the steepening time is much shorter than the
particle trapping time. After a shock condition
is reached, solitary spikes are observed from the
velocity of the wave peak which eventually changes
the feature of the steepening. The final wave
the feature of the steepening that itself component
ward tilting of its magnetic field component
damping).

\*\*Description\*\*
\*\*Desc (angustosonic wave, damp(ug). 1. Gaoghys. Res., Blue, Paper |Alift?

\$360 Solar wind interactions with soon and 5160 Solar vind interactions with some and planets
ILMS SCAR WHEN INTERACTION WITH MARS RE-VISITED
ILMS SCAR WHEN INTERACTION WITH MARS RE-VISITED
ILMS SCAR WHEN INTERACTION WITH MARS RE-VISITED
ILMS Ampless CA 90021) and R.T. Holter
Los Ampless CA 90021) and R.T. Holter
Due to a punctry of observational data, no
clear consenous has been reached concerning the
start in particular, the praylous analyses are
intil at odds regarding the particular of a casel
intrinsic file is segmenteephore at Mars as opposed
intrinsic file is segmenteephore interaction of a.T.
to a vector type localphoric interaction of a.T.
Dussell, 1978s, ht Tolkloop, 1978s, c). This study
Existent intrinsic to the resolution of the question in Bussell, 1978s, ht Dolgicov, 1976-41; This set contributes to the resolution of this question three ways. Pirst; an isproved datamination of three ways. Pirst; an isproved datamination of frostive obsatele attitude and shape is obtained frost the Mars 2, 3, and 5 bow shook secondatare through the was of a recently published entaing of gasynmate flow solutions (Spreiter and

Stabara, 1980a,b). Secondly, building upon the Plonsor Verus Findings at a field-free planet (Brace et al., 1980; Elphic et al., 1980), it le show that the Martin locosphera cannot support a Venus-trye longause at the obstacle altitudes inferred through our rodeling of the bow wave observes ions even when easian induced locaspheric magnetic fields and soler maximum MNV levels are assumed. These results allow an effective Mars magnetic dipole noment of 14 (10.4) a 1022 G-cm² to be doterwined which at ends off the solar wind over the dayside beniephors at statistical ranging from ~ 500 at the subsoler point to ~ 1000 km over the terpinator with un direct and from the ionosphere under average noise wind/magnetospheric conditions. Thirdly, a search of published farms and Mariner radio occultation measurements produced no evidence for the unietome of an ionospace at Aras in agreement with the Viking study of Lindal et al. (1919). Rather, the electron density altitude profilos appear qualitatively consistent with the Martina ionosphere terminating in a champause associated of the later force. sphere terminating in a champouse estaclated with the effects of appareopheric convection as first proposed by Saver and Hartla (1973). After a review of the various arguments in the literatura, as supplemented by the results of this study, we conclude that Mars most probably pos-senses a small intrinsic fold magnetosphere. J. Geophys. Res., Blue, Paper 141202

5360 Solar wind Interactions with genn and planets
THE SOLAR With INTERACTION WITH MASS RE-VISITED
J.A. Slavin (Institute of Geophysics and
Planetary Thysics, University of California,
Los Angeles, CA 90024) and R.E. Holser
Due to a paucity of observational data, no
clear commonsus has been reached concerning the
general nature of the solar wind interaction
with Mars. In particular, the previous analyses
are still at odds regarding the exteuring the
general nature of the solar wind interaction
(e.g. Russell, 1978a,b) Dolgthow, 1978b,c). This
study contributes to the resolution of this question in three ways. First, an improved determination of effective obstacle allitude and shape
in obtained from the Hars 2, 1, and 5 how shock
encounters through the use of a recently published
catalog of gasdynamic firm solutions (Spreiter
and Stahers, 1980s,b). Secundity, building upon
the Ploner Venus lindings at a field-free planet
(Barse et al., 1980; Elphit set al., 1980), it is
shown that the Martian lennesphere cannot support
a Venus-type Innepasse at the ubstacle attitudes
inferred through our modeling of the low waysobservations even when sational indeed InnespherIn magnetic fields and sales maximus EMV leavel-5360 Solar wind Interactions with goon and sheerest tone even when seatmal induced incomplet congressions even when mean satisfies the levels are assumed. These results allow an effective Mars magnatic dipole moment of 1.4 (10.5) x 1974 G-reg to be determined which stands off the schematory. wind over the dayside hemisphere at mittudes ranging from a 300 at the subsplar point so. 1000 km near the torinetor with no direct aid from the lonosphere under average solar wind/magnetaspheric conditions. Thirdly, a search of published hars and hariner radio occultation measurements produced no evidence for the cassiance of an long-space at Hars in agreement with the Vibing study of Lindal et al. (1971, Ranber, the electron density altitude profiles appear qualitatively consistent with the Magnian long-sphere terminating in a chempanes associated with the effects of casgnatospheric convection as first proposed by Beuer and Harrie (1971). After a raview of the various arguments in the literature, as supplemented by the results of this study, we conclude that Mars cost probably possesses a small intrinsic field caspetosphere.

J. Geophys. Pes., Blue, Paper 141202.

## Particles and Fields— Ionosphere

MEASUREMENT OF MIDDLE -ATMOSPHERE ELECTRIC TIELDS AND ASSOCIATED PLECTRICAL L.C. Hato (lonosphure Resourch Laborator).
Electrical Engineering Department, The Pennsylvania
State University, University Park, PA 169021 C. L. Croskuy and J.D. Michell

C. L. Croskuy and J.D. Mitchell
A simple anisma for measuring the vertical classific
Beld in the "middle atmospheru" has been flown on a
number of rocket shanched parachetes for particulat,
We present hare the data from the first nine, such
flights, launched under a sartet, of geogleystal conditions, along with electrical conductivities measured
simultaneously. The data include indications of la series
are distincted to several voits per moter in the mesospheric
selection that any local strategies in the mesospheric field at high and low latitudes in skuntiens of relative by low conductivity. During an auroral "REP" and the electric field reversed direction in the load stratesphere, accompanied by a subjustful exhausment in conductivity. The data generally do not confirm speculations based only on the extension of the thunderstorm circuit from below or the mapping of ionospheric and many name out on the mapping of the seem to require in addition, internal generation processes in the middle atmosphere. Geophys. Res. Lett., Paper 110033

With High-latisude ionosphoric cutrents in the parties of Eff And off waves by Potar Electro-per booklation: Emphasion and MESUITS P. Stubbe. H. Repla (Mas-Planck-Institut für Fartemburg-Lindau 5, Germany) and B.L. Oyaden (University of Otapo, Dunedin,

New Feelands:
The Herting facility as Rosi jordoon open fronts, horsely, bus been used to redulate the polar electricist at transmission in the ronge let to you at . his viv signals were received on the ground in the full frequency range, with applitudes of the order in to 100 ff for an offer interministical the power of 12 Me at 2.05 Miss. A variety of experimental results is presented in this J. Geophys. Pos., Blue, Paper LACISC

5595 (cnospheric Disturbances DOMINANT CONFIGURATIONS OF SCINTILLATION-PRODUCING IRREGULARITIES IN THE AUPORAL

DOMINANT CONFIGURATIONS OF SCINTILLATION-PRODUCING IRREGULARITIES IN THE AUPORAL ZONE

E.J. Fremous and J.M. Lansinger (Physical Dynamics, Inc., Pellevie, WA, 9809), USA)

Simililation observations in recent years have discissed sheetilke plasma-density irregularities aligned along L shells in the auroral-zone innosphere. Such irregularities produce a line of enhanced cimililation across the sky as observed from a single observing station, the enhancement coinciding with the intersection of the station's L shell and the scattering layer. We have emploited this aspect sensitivity to identify time and latitude regimes in which the dominant configuration of F-layer Irregularities observable from a station in the classical auroral zone is either sheetilde or codine (showing axial symmetry about the magnetic list). Employing measurements of VHF phase and amplitude scintillation obtained at Feber Flat, Alaska (L. ; 3.) Irom 1043 passes of the INA Wideland atolitie, we find evidence for sheetilde structures only on the right side of the earth poleward of the high-initials activities in boundary (Aarons et al, 1969). Scintillation is sometimes detected equaterward of the night-side boundary, and it is attributable to faceth irregularities in the main trough. We observed geometrical enhancement in this region only either about the degrees of the magnetic region only either about the degrees of the magnetic region of the dayside scintillation boundary. Careful trapection of the dayside scintillation degrees of the magnetic region to the dayside high latitude arimidiation region could be identified. See metical enhancements were observed not the magnetic region, but the high-latitude arimidiation region could be identified. See metical enhancements were observed not the magnetic region, but the magnetic region, and the dayside high latitude arimidiation region could be identified. See metical enhancements were observed not the magnetic region, and the dayside high latitude arimidiation to degree of the high-latitude sciol only polerand of the high-lithingle schedulers are on the hight rate of the earth. Askal same the norm elsewhere. (Schooldation, ion-schedu Included: J. Leophes Pes , Pines, Paper IAII-0.

SAO Particle procipitation
b(CA) OF FASI ION STRUCTURE IN THE IONOSPIPE
5. R Goldman and J. L. Sperling (JARLOE, in
Diego, California, 22138

Both proton auropal and domested linewing ten
events have significant fast ion corponents. In
these phenomens we demonstrate that charge eschange and collisional ignization processes can
exert a strong effect on the imaging of icrited
density structure to the lower tonoschere. Inis
has value in relating ionized density spectral
measurements at altitudes of the Fregion maximum
and below to plasma behavior at higher six-rudes,
as well as providing initial conditions for bocally driven plasma instabilisties. It is shown
that charge exchange of fast ions into fast neuture with neutral mean free paths much larger than
the structure discessions and the generation
of structure of larger size. For structure with
dirensions much larger tran the neutral max free
path, fast neutral loss is diffusive rither traconvective and attenuation of structure is less
rapid.
J. Lendows Res. Blue, Place 134201

rapid. J. Sesphys. Res., Blue, Piper 141241

SEED Mave propagation
AUTOMATIC CALCULATION OF ELECTRON DEASITY SPORTLES
FROM DIGITAL IGNOGRAMS. PART I, AUTOMATIC O AND R
TRACE IDENTIFICATION FOR TOPSILE ICACOPANS
ROOD N. Peinisch (University of Lowell Center for
Automatical Pewsarch, 450 After Street, Lowell,
MA 01854) and Husery Musein
This first paper, in a series of three describing
the automatic processing of digital inorgars, discusses the scaling of teptide ionograms in a ground
tased minicorputar. The objective is to automatically obtain the vertical electron density profiles.
The Topside lorogram Scaling Algorithm (1(XA) first
the resonance and cut-off frequencies, and the vertical O and I serb traces. Application of TISA to
digitized ISTS 1 and 2 ionograms illustrates its
performance and demonstrates the feasibility to
automatically scale topside ionograms. The ISTS
studies show that polarization tagging of the O and
I signals should the done in a digital satellite
scunder to assume successful, real time scaling of
complex lorograms. (Digital ionograms, tepside
sounding, automatic scaling).
Fair Sci., Famer USI201

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Gracheva M. E. Gurvich A. S. Simple Model for Calculation of Turbulent Noise in Opilical Systems

Opilical Acceptance of Acceptance of

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5580 White propagation.
INTERSTRY SIGNIFICATION PARAMETERS FOR CHARACTERSZYN . SERY (NOW CHIRD) - PADS

Access to the constraint of the second of th tentative type in the tent the model of spline and in the set of the differential equation that special tit behavior of the observation of the content of the second tit behavior of the tental of the model of the second title to the data with or equipment second the content of the second title to the data with or equipment second the content of the second title to the data with or equipment second to the second title to the data with or equipment, properly title well to the second title to the data with or the second title to the second title title to the second title title to the second title ti the section of the relative configuration of the section of the se wied to dopon a van senit wantallation arbo-cition. Caltifre powey wantallation data ac-tro-cate to dominante the campt. Bad. Ser , Paper ISHIGA

5599 Conerat or miscelland as THE CASE OF THE MODES DERIVATIVES - PUBLICAL FOR A SPACE MATE-PLASHA INTERACTION V. B. Lunson and R. L. Crayla Centur for Space Sciences, The Volcentry of Teras at Bollas, Richardson, Terus)

An increase, The University of Terms to Dallas. Richardson, Teamy of Terms to Polias. Richardson, Teamy Data From the Potenting Potential Analysism on Atmosphere Employers f and D indicate the spin-tenes of 2 meter irregularities in the ion Flust to the satellites. These bregularities are some only occasionally, and usually vary near the magnetic dip equator. They occur toth in sunitational eclipse and again at least two decades of ion concentration. They tend to be present when the appearant in moving nearly parallel to B and are not soon at all from the low lucitode AC-I othic. We believe the tregularities, whose amplitude in of the order of one percent of the background ton flus, are the result of magnetizate interaction with the incomparate plants. A mechanism for producing this interaction that utilises a fest here of ambient ions reflected systems from the satellites to produce

#### Particles and Fields---Magnetosphere

Magnetosphoro

Nios Row shork waves

Solar Wind Flow About the Terrystrial Flabits

1. Modeling tom Solick Publisher and Shape

1.A. Slavin (tonetute of Gorphysics and

Plemetary Physics, University of California,

los Angeles, CA 90024) and R.E. Holser

General techniques for modeling the position
and shape of planetary bow waves are reviewed.

A three parameter method was selected to model
the near portion (i.s. x' ' - 1 Pa) of the Yenus,
earth, and Mera bow shocks and the results compared with estating models using 1 to 6 free
variables. By limiting consideration to the forward part of the tow wave only the region of the
shops and sine was semined. In contrast, must
wither studies include portions of the bore distank downstress shock thus tending to reduce the
planetary magnetosphers in question to a point
cource and constrain the resultant models surfaces
to be parabolate or hyperbolad in abape to avoid
downstress closurs. It was found by this investigation that the relative effective shapes of
the near Martine, Cythereso, and terresertal bow
shocks are ellipsoidal, parabolated, and hyperbolation, respectively, in response to the increasing blunteress of the obstacles that Hers,
Yeons, and eath present to the solar wind. The
praition of the terresertal shock over the years
1205 to 1972 showed only a west dependence on the
phase of the solar cycle after the effects of
solar wind dynasic pressures so magnerophuse Icention were table into account. Sowners, the how
were of Yeous was considerably more distant
around solar manham in 1979 than at enfoltence in
1973-5 suggesting a solar cycle arteriation in its
Internation with the solar wide. Finally, ac
significant deviations from attain your distant
around solar manham in 1979 than at enfoltence to
1973-5 suggesting a solar cycle arteriation in its
Internation with the solar wide. Finally, ac
significant deviations from attain the earth and
Yeous were rayed into the aberrated terminator
plane. This firding is in agreement with the
prefects of the C

I. Prophys. Pes . Sine, Paper 141147

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OF THE STRICTURES AND MAPPING
OF ALPOPAL ELECTROSTATIC POTENTIALS
TO TO CONTROL SERVICE LABORATOR, The
Accordance Components, Elegande, CA 49245;
A. L. Francia and J. H. Corcasall The command J. F. Connail We continue to magnetospheric and the improve of magnetospheric and the impression of magnetospheric commands and the continue to th return current always exists unless the inno-aprece is the tructile barged to ground un-physical sales. We are able for the first time to pile a select precommending call plattate of the tructile is according return carrent and the high-state, presipitation of an invested-V. The state of the tructile is phrased in terms of a tructile interior tructile terms of a tructile in action, but have a selective, empha-tical tructile in the action of a tructile is action and if years appeared latticianal spatial scales is selective, the electificial length as roughly to the sall use on the invested-V region, its phase is a true to be length, when the light of the properties also electric field task abuse the unappeare, given the magnitude of the grantles per task dry between the tonsthat above the exhiptener, gives the magnitude of the carallet pure that drop between the tonor agine and equal real reagences here. A presence collection to recent more quantities is given for the time time of in the body of the paper, present a two-discounted breets, in which has, taken the parallel puts itself drop as an accounted seen.

" Pichis Per , Blue, Paper 1841)&

With interaction between sufer wind and suggestethere the star the submittee at the desertion in the transfer and there is, and appearing at the desertion in the star is, and the star is anot in the star is and the star is and the star is and the star is theresation by Chis-1, supported by data col-lected by 197-1, 197-2 and ATS-6 during the 29 1-1/4 1971 action steam commercement have been used the devices the paspetoposist's position (1.5 Mg before and t. 1 Mg after the BSC), veloc-try threated speed of about 95 buffer by two laity thread speed of about 93 buffer by two in-deposites outside and thickness to 500 km mea-need by the change in drift patters). Particle, field and ware done from CDS-1 have been used to untablish the satellite's position with respect to the magnetopouts. After the faitial crossing of the magneterate, the satellite remained is the magnetisheath for wors of the inversal attered, occasionally encountering what are in-terpretated as "agan magnetic field kines", the the agas ecode was in the magnetodienth, derives plares first tergential to the magnetoposes are derived from our electric field measurements. The flow on locity was higher during and derived from our electric tanks measurements. Dat flow we locity was higher during periods when the interplanetary magnetic field latimed a realisered component as compared to periods when a merimand component two present. On these oreasisms, as un-wironment was encountered which was matcher typi-cal magnetospheric or magnetosbeath-like, it is argued that in those instances GEOS-1 sither re-rotated the magnetusphere or encountered a "mag-pera, island", caused by a tearing made instabil-it; at the magnetingame, the electric field diapped to sets or very small values in these in-

1. Scophys. Bes., Pluo, Paper 141145

5770 Interactions between solar wind and carnetosphere A MOTE ON THE ECCATION OF THE STACHATION POINT TO THE MAINTENEURAL FIRST C.T. Bussell (Institute of Complete and Pinet-tary Physics, University of California, Lou

C.T. Bussell (Institute of Graphenics and Plane Lary Phosics, Bullwersite of California, Lou Angeles, CA 70045)

H-G. Zhong, B. I. Molour and S.H. Fronbert Inheritanial and theoretical investigations indicate that the shape of the magnetosphere is nearly symmetric about the plane defined be the abstrated solar wind value it. In any the catch's regnetic dipule acis. Nevertheless, many phanomens such as magnetic pulsations and geometric activity seem to indicate that the effective solar wind arrival direction is perhaps 150 to the dawn side of moon. This apparent paradex may have a simple secolution since it can be shown that the location of the atagnation point in the magnetospheric files to shift towards alam by MiD effects not included in the intellegand shape of the major and interaction. The shope of the regnetosphero is little affected by the inclusion of thems MiD offects. Nowsee, the large of the stage with interaction that it is very sensitive to the Affect Mochen and can calve account for the largent reported shifts in very sensitive to the Affect Mochen and can calve account for the largent reported shifts in 1501 at low Mach numbers (4,19). Istageation point, magnetosphesic, agencie palestone).

Gambers, Pec. Lett., Paper 111159

ION TESTING AT THE PLASMA SHEET BOUNDARY: SIMULTANEOUS ORRENVATIONS OF INCIDENT AND M.X. Andrews (Physica and Engineering Laboratory, Private Day, Lower Hutt, New Zeal and P. M. Daly and E. Ropplet Data which show energetic tons jetting towards the earth at the planta sheet boundary are presented. The tone are spatially dispersed such that the most energetic particles lie furthest (rim the neutral alcet. Simultaneously, non-thermal ion spectra were seen in the small particle fluore wing from the earth. Thene particles are helieved to be the earthward jetting tons after their reflection mar the carth. It is argued that these dispersion effects result from a combination of a tailwards moving

5139 Magnatopause

AGGMETOPAUSE MUDELLAG: FLUX TRANSFEF EVENTS AND

MAGNETOSHEATH QUASI-TRAPPED DISTRIBUTIONS

T. W. Spelser (Dept. of Astro-Grophysics, Campus

Box 391, Univ. of Colorado, Boulder, Cu. Rollos)

Source and a cross-tail electric field. Geophys. Res. Lett., Paper 11.1138

T. W. Spelser (Dept. of Astro-Grophysics, Campus Exx 191, Maiv. of Colorado, Boulder, Cu. 80 109) D. J. Williams

Three-disensional energetic ion distribution functions near the magnetopouse from 15E-1 are examined for Newember 10, 1977. Magnetospheric distributions initialize perficie orbits in a steple, quasi-static, one-disensional suspetopause Excile. Particles are followed into the capacitaheath and the modeled distribution to compared with the observed. The results indicate the necessity of a "connected" flux tube for this time period, but reconnected—like tangential electric flaids are limited to about 172 my/m unless they are quites localized. Quasi-trapped Jistributions observed in the sheath say be due to lone with large pitch angles which less out to come clowly them the ions at staller pitch angles. (Magnetopause, surgetic lane, reconnection, models, flux transfer events.)

J. sempleys. 96s., Blue, Paper [Mil44]

3719 Magnetopause
THE THICKNESS OF THE MAGNETOPAUSE CUPRENT LAYER
ISE-1 AND -2 OBSCRWATIONS
J. Berchas (Institute of Geophysics and Planetary
Physics, University of California, Los Asgales,
California 30024, U.S.A.) C.T. Russell
A survey of the tempretopause thickness ower
the dayside magnetosphere is carried out by
using the taggestic (feld measurements from the
twin ISER-1 and ISER-2 UCLA flungate magnetomatures. The magnetopause is the range of local
time from 0500 to 1700 and at GSM latitudes from
20 to 150, is found to be in constant rapid and
irragular totion with velocities ranging, in 80t
of the cases, from 10 Ko/s to 80 Km/s, and the
current sheet thickness from 400 to 1800 Km. The
thickness seams much better ordered by dipole the magnetic squator the magnetopause current sheet is chimnest, about 500 fb on everage. This observation suggests that reconnection is initiated in the equatorist regions rather than in the polar cusps. J. Geoghins. Res., Blue, Paper 141169

5739 Magnetopaume EVIDENCE FOR QUASI-STATIONARY PECCHYECTION AT THE ATSIDE AUGITOPHEE SILVERS OF CRISTON AT THE DATSIDE AUGITOPHEE J. T. Gosling University of California, Los Ilamos Nations) Laboratory, SSO-MS 436, Los Alesos, MR 675491, J. B. Astridge, S. J. Bame M. C. Faldman, G. Paschwarn, H. Schopks, and C. T. Russell

W. C. Faidemm, G. Paschmann, B. Schopks, and C. T. Kassell
Several highly unusual ancounters with the earth's angestopause occurred during an \*5-bour period on Bovenber 22-21, 1979 when the 1921 and 2 satellites were mean orbit apoges (\*22.2 F<sub>c</sub>) at 6000 local time. These distant magnatopäuse arosaings corresponded to a subsolar earthmagnatopause distants of \*20.8 S<sub>c</sub> and were magnatopause flows, whose magnatudes and direction were consistent with the predictions of reconnection theory, were observed on each of several satellite encounters with the appetopause and boundary layer during this 5-bour period. Further, the field veriations through the engatopause had the atructure of a rotational discontinuity as required by reconnection theory. These observations the distant with the appretopause had the distant of a rotational discontinuity as required by reconnection theory. These observations is the distant and appetopause on be a quasi-Lines thus indicate that on commiss reconnection at the deside majestopuse can be a quasi-stationary process. Commissation continuity during this 5-hour period and for at least 9 hours thereafter was extremely low. Thus dayable reconnection is certainly rat a sufficient condition for enhanced (secasanstic activity. (Reconnection, magnetopause).

the Prima mertin, care them, or circulation in all site starts of average captry a catastic of trajectors of Figure or Later can. Interest of Trajectors in the start of the catastic of trajectors of sucreman filter found to color as the scute of sucrema filter rests that catastic of the scute of sucrema filter rests to the scute of sucrema filter catastic of the start of the sucrema filter and the sucreman filter of the sucreman filter of the sucreman filter catastic of the Sauphys. Per. Lett., Paper BLIGHT

J. Georgia, Pes., Blue, Paper 141127

5763 Plansaphous 1982-1, Plank In The 1982-1 06522471085 OF THEREIL, Plank In The Yildhill of the Planksphere out the Periods of Ottoring Recurring Activity. J. L. Horyitz (Thyritz Department, University of Alabam, Buntaville, Alabam, 35675), C. R.

Baugher, C. B. Chappell, E. G. Shelley, D. T. Young and E. R. Anderson
Thermal (5 100 ulectron volts) ion observarions made with the Plasma Composition Experiment on ISE-1 are combined with plasma density
profiles obtained from plasma frequency measurements made with the Plasma Mrue Experiment
to conduct an investigation of thermal plasma
behavior in the wichnity of the plasmasphere
duving periods of quieting magnetic activity.
Mormally, the principal thermal ion population
in the plasmasphere consists of cold (AT c)
in the plasmasphere consists of cold (AT c)
in the order of designance H'sie\*: o', while
outside the plasmaspuse, the observed F < 100
eV ion distributions usually are flaid-aligned
in structure, have characteristic enorgies
E ≥ 10 eV and H'10\*: ilo\* order of dominance in
flusma. During periods in which the magnetic
activity quiets, the above two regions are
separated by a new region in which, at those,
low-energy (-1-2 eV) H and Re\* are found
flowing along the magnetic field ilnes. On
other occasions following quieting magnetic
activity, pancake distributions (peak flures
at 10° pitch angle) are observed in this
region. Other complex distributions have been
seen, and these complex distributions and the limitafactory simple interpretation. It seems
plausible to identify this region as the site
of plasmapshere refilling. However, th

5763 Plasmapause
LONGITUDINAL VARIATIONS OF PLASHAPAUSE RADIUS
AND THE PROPAGATION OF VLF MOISE WITHIN SMALL
(AL - 0.5) EXTENSIONS OF THE FLASHASPHERE
A. J. Saith (British Ameretic Survey, Cambridge, EMCLAND) D. L. Carpenter and M. Loster
Simultanaouse broadband whistler recordings
made during the International Hagnetospheric
Study (188) at the two Antarctic statione
Halley and Siple have been used to study
longitudisal variations in the radius of the
plasmapause observed during local aftermoon.
In both of the two pariods studied thus far,
whistler-derived equatorial electron doneity
profiles imply an increase in plasmapause radius between the longitudes of Siple and Halley (A) - 10°) of AL - 0.5. Interns VIF noise
(-2.5 MHS) was observed at Halley but not at
Siple, and by scho analysis its propagation
path was identified with that of a whistler
component travelling close to the plasmapause
vichin the region of larger radius. This leads
to the conclusion that the notes was generated
by a syroresonance instability when energetic
electrons (typically 10 keV), drifting eastwards in the plasmatrough, encountered enhanced
plasma density to the small extension of the
plasmanphare. (Plasmapause radius, VIF noise).
Geophys. Fos. Lett., Paper Itili39

ophys. Res. Lett., Paper 111139

into the morning soctor. J. Ecophys. Res., Blue, Paper [AtlA]

PARTIES AND THE STATE OF THE STATE OF THE ALL STATE OF TH tudinal coverage, respectively. In an attempt interpret these results a physical model based upon observational data concerning auroral elec-tron pracipitation and innospheric conductivity has been developed. It is postulated that elec-tron precipitation is the dominant cause of ionihas been developed. It is posturated that electron precipitation is the doninant cause of ionization responsible for the conduction of the westward electropiet throughout the year. In the fall and winter months the electropiet is confined to the band of precipitation while in the spring and summer months the contributions of solar ionization paralts a latitudinal spreading of the currents. The model predictions are consistent with the observed pattern of change of the average value of Al for the individual AE stations between the winter and summer solstices. It is also consistent with the change in the frequency with which the stations contribute to the determinations of the Al index between the solstices. The results indicate that Al is best suited for estimates of the mastward electropic on a continuous best during the spring and summer months. An observed increase in the average value of Al with decreasing corrected magnetic latitude is interpreted as due to larger electropic turrents associated with larger magnetic disturbances which produce an aquatorward displacement of the polar cap boundary. J. Geophys. Res., Blue, Paper 1A1145

3770 Short-pariod (less than 1 day) variations of magnatic field PCI DISSIGNS IN THE AFTERMOON SECTOR PRIOR TO THE JULY 19, 1977 SUDDEN COMMENDEMENT J.V. Oilson (Geophysical Institute, University of Alaska, Patrbanka, Alaska 19701)

A merian of three attructured Pcl events were observed prior to the July 29, 1977, sodden commoncement by magnatometer stations at College, Alaska, NacQuaria Inland, Amatralia, and Vostok, Antarctica. Signal characteristics of the events lead us to lafer that the near-comjugate Oilage and NacQuaria Inland stations were near the source field lines for the second of these secons. Pros the growth rates for lan cyllotron waves calculated from linearized equations for an anisotropic, drifting plasma we have inferred the presence of fresshy injected plasma in the efternoon magnatosphere after 2310 UT at L = 5.4. This is consistent with the intersect convection to be expected with the observed southward turning of the interplanetary agnatic fleid prior to the sudden commencement. J. Geophys. Res., Blue, Paper 141146

5775 Trapped particles 18EE-1 OBSERVATIONS OF OTT IN THE MACNETOSPHE ISEN-1 OBSENVATIONS OF O<sup>++</sup> IN THE MACHETOSPHERE
J. L. Horvies (Department of Physics, University
of Alabase in Hustavilla, Hustavilla, Al. 35899)
Observations of O<sup>++</sup> by ISEN-1 have revealed
occasional O<sup>++</sup>/O<sup>+</sup> density ratios of the order
unity within the plasmamphere. However, most
plasmampheric O<sup>++</sup>/O<sup>+</sup> density ratios are generally below O.3. These ratios agree generally with those seen by GPOS-1. Within the plasmasphere, the O<sup>++</sup> population appears to be primarily rold and laotropic (as is typical for
major ions). Outside the plasmamphate, O<sup>++</sup>/O<sup>+</sup>
(field-aligned flux ratios may be of the order of
O.1-O.2, though they are frequently much smaller,
and the O<sup>++</sup> distributions are typically fieldaligned. A rare observation of a unidirectional
conic in O<sup>++</sup> is also reported.
J. Geophya. Res., Blue, Paper 141120

5775 Trapped particles
LONG-TERM INTERSITY DECREASE IN THE 8-25 MeV
PROTON FUNDES AT LOW L VALUES
Daniel R. Pareignault (Physics Research Division,
Emagnuel College, Boston, Massachusatts 02115)
Ernest Holeman and Robert C. Film Emasuel College, Boston, Massachusetts 02:15)

Ernest Holeman and Robert C. Fils

A five year continuous observation, 1963 to
1968 of the 8-25 MeV proton pepulation, at I <
2.0, hed shown a sometomic decrease in this population. We have observed the same proton population from 1970 to 1976, using experiments flow on several USAF satellites (72-1, 53-2, 53-3).

These data together with published data from the DIAL satellites show that the decreases in the proton fluxes first observed from 1963 to 1968 have continued unabsted, at least until August 1970, and with the same original mean lives. The proton flux at I = 1.35 decayed over the 13-year puriod (1963-1970) with a mean life, T, of 5.7 ± 0.5 years. At I = 1.90, t was 4.55 ± 0.16 years. However, the proton flux at I = 1.20, which had first been reported as constent, created decreasing ~ 1970 to 1976 with T = 3.07 ± 0.25 years. Possible explanations for this phanomanon can be divided into the two categories of natural and srtificial effects. We reviewed these different effects and conclude that must lifely we are seeing the decay of the high energy protons redistributed by the "Starfish" high shitiude nuclear explosion. (High energy protons, trapped part [clas]). Blue, Paper tangen.

5775 Trapped Particins A COMPARISON OF CHARACTERISTIC TIMES FOR SATELLITE ABSORPTION OF ENERGETIC PROTORS TRAFFED IN THE JOVIAN AND BATURNIAN MAGNETIC FIELDS L.L. Rood (Luper and Planetery Laborators, L-L. Rood (Lunar and Flanatary Laboratory, University of Arizons, Tutsons, Arizons 85721)
The relative symmetry of the Saturnian magnetic fluid with respect to the rotational equatorial plane results in characteristic times for setalite absorption of trapped emergatic protons that are typically one to three orders of magnitude smaller than the corresponding Javian satislite absorption times. The marisum difference occurs for nearly equatorially stronger particles. Assuming that the resease stretain particles. Assuming that the rates of tadded diffusion are comparable within the two magnetospheres, the inner Saturales sacalities are more efficient absorbers of invaridy diffusing ions then their Javian counterparts. Thus, via the medianism of satulities absorption, the rotational symmetry of the planetary negretic field may play an important indirect role in determining gross properties of the redistion Geophys. Ros. Lett., Paper 111160

5777 Andesite-rhyolite
PETEOGENESIS OF OCEANIC ANDESITES AND
PHYOLITES.
5. Haside and T.S. Petersen (Department of
Goology, Allegaton 41, 5014 Bergen, Norway)
The andesites of the Intra oceanic
island arc systems vary in silics content
from 49-508 SiO, to sbout 768 SiO, The
most primitive Compositions with Sbout
50% SiO, the besaltic andesites, are
primary compositions generated by partial
meiting of the subducted oceanic crust.
The oceanic andesites can not have assimilated material from the continental crusts
and their perrogenous afford information
about the processes occuring in the
Benioff zones. The compositions of oceanic
and continental rhyolites are different,
reflecting a different source materials
for the two andesitic series. (intra
oceanic island arcs, andesite, magma
generation).
J. Geobyk, Ras., Rod, Paper 180006 generation). J. Geophys. Ros., Rod. Paper 180906

\$799 General or Miscellaneous-Magnetosphere
PLASMA NEAR IO: ESTIMATES OF SOME PHYSICAL
PARAMETERS
M. G. Kivelson (Institute of Geophysics and Planetary Physics, university of California, Los
Angeles, CA 90024) and D. J. Southwood
Models of Io's interaction with the Jovian plawma
are examined to assess whether conditions hazardous
to a spacecraft flying by Io at about 1000 km above
its surface should be anticipated. Only two models
are regarded as consistent with most of the presently available data. The "ionospheric" model allows field-aligned currents to close through Io and
its ionosphere. The "magnetospheric" model allows
the currents to close on an Ionian magnetopause and
across a tail neutral sheet. Although only the
latter model provides an explanation for the pitch
angle distribution of energetic electrons measured
by the LECP detector on Voyager 1, the implications
of both models for near-lo plasma are explored.
The plasma density is found to be roughly the same
near to and elsewhere in the torus. In To's wake
the plasma is hotter than elsewhere in the torus
but in the extreme case the ion temperature is
merely of order the temperature in the terrestrial
ring current. No special problems are anticipated
for a spacecraft subject to these plasma conditions.
J. Geophym. Res., Bluo, Paper 141171 J. Georbyn, Res., Blug, Paper [A]171

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Krivoshein A. A., Ovchinnikov I. K., Pozdnjakova L. I. Differential thermal e.m.f. of pyrite from 78 to 873° K.

**Physical Properties of** Rocks

white Electricity, fracture and flow PRICUTE EMERTY OF STICK-SLIP EVENTS IN A LARGE SCALE BALLAL ETHERMENT P.G. Ondo (U.S. Geological Survey, J45 Middle-field, Mende Pert, C. 94025) J.E. Dieterich The concept of apparant Fracture energy for the shear failure process is employed by many authors in modeling earthquake sources as dynamically extending shear cracks. Using records of shear statis and rolative displacement from stick-slip events generated slong a simplicited, prepared fault surface in large (1.5 m x liex 0.4m) greatts block and a slip-weakening model for the fault, direct satinates of the sparent shear fracture energy of the stick-slip events have been obtained. For events generated as a flooly ground fault surface, apparent fracture energy ranges from 0.06 J/m² at a normal stress of 1.1 NPs to 0.8 J/m² at a normal stress of 1.5 NPs to 0.8 J/m² at Couphys. Res. Lett., Paper 1L1073

610 Elasticity, fracture, and flow INCLURIC OF STRAIN RATE ON DILATARCY AND STREAM OF CHINA GRANTE UNDER UNIAXIAL COMPRESSION 0. Sae (Faculty of Engineering, Yamaguchi University, Ube, 755, Japan) I. Ito and M. Terada uniaxial compression tests have been conducted on Uniaxial compression tests have been conducted on Uniaxia rates ranging from 10° to 10°°. The results showed that the strength and the acoustic edision rate increased exponentially with increasing strain rate defined by the differentiation with respect to the stress increased with decreasing strain rate.

The redistribution of microcracks due to sub-ritical crack growth was considered theoretical-

The redistribution of microcracks due to sub-rifical crack growth was considered theoretical-ly and the equations derived from the theory was compared with the experimental results. The agreement between the theoretical and experimen-tal results shows that straws corrosion plays not only a major role in the brittle creep under con-tion load but also dominates the strain rate effects on strength and dilatency observed in the constant strain rate loadings. (Strain rate, stress corrosion, dilatency, strength.)

bild Electicity, fracture, and flow Concess on 'THE EXPECT OF PRESSURE ON THE RATE OF DISLOCATION RECOVERS IN OLIVENS' BY D.LEGELSYEDT, N.P. X. STCHOLS, AND PAUL HORMACK b.L.GOLSTEDT, R.P.K.HTCHOLS, AND PAIR MORMACK Lights (Ocean Research Institute, University of Tokyo, Kimmidal, Nakamo, Tokyo 164, Japan) is a recent paper, Kohistedt et al.(J.Dapphys. 164, 53,132-3130,1990) have made high pressure Necrary experiments on olivine and estimated the attivation volume for recovery process (as). This method of analysis of the experiments 1 data, however, contains a besic error and the esiculated values of activation parameters, especially the attivation volume, have large effort. The corrected values of activation estroy Q and volume V are, Q-329-18 kJ/mol est 1616 of 20-3/mol, instead of Q-3000-15 kJ/mol est 1 etivation volume). | Ceophys. Res., Ped. Paper 181173

6110 Elasticity, fracture, and flow A CRITICAL ASSESSMENT OF ESTIMATION METHODS FOR

GIIO Elasticity, fracture, and flow A CRITICAL ASSESSMENT OF ESTIMATION METHODS FOR ACTIVATION YOUNG Charles G. Sammis (Department of Geological Sciences, University of Southern California, Los Angeles), John C. Smith and Gerald Schubert We have compared estimates of the activation volume V based on several theoretical models with measured values in metals, assail halides, and olivine. The thouretical methods tasted incluse one besed upon the empirical correlation between activation energy and melting temperature and several which are based upon simple elastic models for the defect structure. For metals and olivine, the melting relation works well, but for alkall halides, the melting model predicts too large a V by an approximate factor of 1.5. Of the elastic models, the dilatational strain energy model introduced by Zaner (1942) provides reasonable estimates of V for metals and olivino, but it also overextimates V for alkali halides. Zaner's (1942) assertion that the experimental value of V should be bounded by theoretical values calculated from strain energy models which assume pure shear (Kayes, 1963) and pure dilatation is supported by the available date for metals, oxides, and sikali halides. These provide upper and lower estimates for the variation of viscosity with depth in the mantle.

J. Geophys. Res., Red, Papor 181176

6110 Elasticity, Fracture, and Flow UPPER NAMPLE VISCOSITY DERIVED FROM THE DIFFERENCE IN RESONNEY OF THE PROVO AND DOWNEY LLE SHORELINES: LAKE BONNEY ILLE BASIN, UTAN Q.A. Passey (Division of Gaological & Planarary Sciences, California Institute of Tachnology, Pasadena, California Institute of Tachnology, Pasadena, California Pility)

Twenty-four new field measurements of alevation of Provo-lavel and Bonneville-lavel shorsline terraces provide data for vannelysis of immediate trabound in the Lake Bonneville hasin. Analysis of the differential rebound of 49 m and the Bonnaville aboraline (maximum rebound of 69 m) requires that the latter he an equilibrium shoreline. Within the measurement errors, the Provo shoreline. Within the measurement errors, the Provo shorelines, within the arrors, the Provo may also represent an equilibrium shoreline. From the new data presented in this apper, the best satimate of the upper latt to the affective viscosity of the uppermost mantle, assuming a half-space model and a 2000 year time intervent between the Bonneville and Econ shorelines, with theoretical profiles from plate flexure model and of aboraline rebound profiles, for both shorelines, with theoretical profiles from plate flexure medals indicates that the sean flexure plate flexure medals indi plate flowers models indicates that the mean flex-ural rigidity of the Besin and Range Lithesphere is 1 x 10<sup>2-8</sup> Be, or allightly Less. (Viscosity, upper mantle, flexural rigidity). J. Geophys. Res., Red, Paper 181272

6190 Instruments and techniques AN INTERFEROMETRIC FIGHT FOR SEATING I.C. VELOCITY AND ATTENUATION IN MOLIT'S RUCKS Y. W. Patabara (Hawali Institute of to aphysics University of Hawaii, Monobula, Hearii 984221, C. S. Rai, N. H. Manghaman and J. Arbeit. An interferometric technique has been haveled for the purpose of measuring distanced velocity and attenuation in roch meits. In exempt, a long wave train is transmitted through two long buffer rock separated by a thin layer of velo. Multiple reflections in the mult layer interfere with each other and give rise to resonance for mail thicknesses equal to integral multiples of ball the uswalength. The velocity and attenuation can be obtained by measuring the multiples of the transmitted wave as a function of either the heir layer thickness or the frequency. The accuracy of the method was tested at these respectative by compressional wave measurement on which, here may and carbon dismitted. Vehiclates were found to be accurate to within 6.77. Vidues of the apartific dismipation factor in 15 to too to 16.75 can be resolved for a liquid meh as water with a low accurate all lippodesses, whereas of viduo as low as 10% can be research for bigh legislate. Inpulsas we have research for bigh legislate liquid such as excently, if white redshifts for all low dismitted agree with problem with the formal families agree with problem with the first of sufficient control of the 10 to 10.00 better rism 0.001. I perform some twickers are not observed by the problem with the first original polymer choose that short termination, and the standard is not to 10.00 better the problem of the standard for the original control of the first standard for the first of the problem which the first of the problem of the distance of the partial relation of the standard for the original that the partial relation of the standard for the stand

#### **Planetology**

6510 Almospheres of Planets MITPOGEN ON JUPITES. A DEEP ATMOSPHERE: SOURCE R. Prinn (bept. of Maloorology and Physical Occupathy, MET. Cambridge, NA 02191) and J. Juguer A study of Irrawerable reactions involving A study of irraverable reactions involving activates introduced and couler introduced and study and the study and the study and the study and the study at the st ıpiter, Saturni . Geophys. Res., Graca, Paper 161122

J. Geordes, Rev., Sinc. Pages 151705

STORY ARE STRUCTURE OF PLANETS AND STRUCTURE VILLE VIL NOT NECOMENT FROM TITAL'S UPPER ATMOSPHERE?

VOLARIER I EXCOUNTER

II. F. Streebel (M. Naci Peacerch Leboratory,

Weshington, D.C. 20175), D. E. Shemansby

Analysis of Titan's EUV emission spectra

shistens in the Toyagor I encounter demonstratus

that electron luyact on Ny above 3500 km accounts

for the bulk of the observed emission shortward

of typens. In conjunction with the UVS solar

contration data it is concluded that Ny is the

other component of Titan's upper summaphere with

upper limit mining ration at 1900 km on No1, Arl,

CU. Ny, and Hi of 0,01, 0.05, 0.05, 0.05,

Olf, seepertively. Magnatuspheric electrons

interact with Titan's unfit hemisphere to pro
duc a power disalpstion rate of v2 x 10° W is

the ecosphere and 2 x 10° W below the exobase

with optical signatures from numerous Ny bands,

Ni, and Nil sultiplets. The Ny C (0.0) Rydberg

band at 958 Å acts or an optical probe of Titun's

ecosphere because of transmission losses caused band at 958 Å acts as an optical probe of Titus's enosphere because of transmission losses caused by finarescence and predissociation. Magnetospheric electron precipitation produces an average dayside olectron density of \*2 x 10 cm² between 1600 and 4000 bm, the region of bright lithe trimsten. When Titan is within batum's magnetosphere, magnetospheric electron input disnociation of Ng generates so N atom in age rate of 1 x 10 mg from from Titan's example to a non-thermal H stom escape rate of 2 x 10 mg from the product of Ng Tollowed by restlone with tile and Hy and termbination to produce that it areas.

Georhys. Res., Blue, Paper LA1209 6960 Meteorists
REFRACTORY SPHERULES IN THE MURCHISON
METFORITE ARE THEY CONDRULES?
1 D Maclogals (Scripps Institution of Oceanography, La John,
California, 92093) Abutual Refractory spherules in the Murchison carbonaceous chanal. Refractory spheroles in the Murchison carboniceous chondries how a range of compoundous similar to those of scenising inegular inclusions. However, the shape and internal restance of the spheroles are suggestion of formation from a logid. The average that the spheroles were ferriedly smallistics significantly in the spheroles are formed by melting of presidual condenied irregular including. If so, they can be properly strend chondrides. If bondrides carbonic should be supposed to the formed by the second condenies of the second condenies.

Grophys. Res. lett., Pager Collists

0575 SURFACE OF PLANSES A SUMPLY MECHANICAL MOREL OF VALHALLA BASIN, CALLISTO
H. J. Melosh (Popr. Farth & Space Sciences, SIRO Ston, Brook, Stony Brook, N. T. 11794
The Valhalia basin on Callisto is a muhiringed Stony Brook, Stony Brook, N. T. 11794
The Vehhalis basin on Castisto is a multiringed structure which extends over much of the satellife's surface. Although its appearance differs in detail from lunar multiringed basins, its origin may also be attributed to lithospheric fragmentation accompanying collapse of the transient crater formed by an impact event. This paper explores the mechanics of the tolispae process by treating the lithosphere as a thin elastic-You Mises plastic sheet (plane geometry) or shell (spherical geometry). Flow one of the underlying asthemosphere invard toward the crater centry induces plastic failure of the lithosphere and produces a characteristic pattern of faults in the disrupted lithosphere, the pattern and estent of faulting is a function of a single dineasionless parameter which involves the strength and talkiness of the lithosphere, the crater depth and diameter, and the surface gravity of the planet. The tectonic structures of Valhalia correspond well with the failure pattern espected for a large crater produced in a time (cs. 70 hall seak (strength - 100 bar).

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